

LITERATURE CITATIONS, PART III

1946-1950

1946

2465. AHRENS, L. H.

Qualitative Spectrochemical Analysis of Minerals and Rocks.

Trans. & Proc. Geol. Soc. S. Africa, **49**, 133-54 (1946).*C. A.*, **44**, 3835c (1950).

A general procedure is given. Selective volatilization is stressed. Special studies were made on Rb, Tl, F, Te, P, and Au in a siliceous matrix. The sensitivities obtainable by use of anode and cathode layer excitations were compared. If sufficient material is available for analysis, anode excitation appears to be equally sensitive, and in a few instances superior, to cathode layer excitation.

2466. ALEXANDRE, J.

Analysis of the Principal Elements of Ordinary Steel by Use of the Three-line Method.

Congr. groupe. avance method. anal. spectrograph. produits met., **6**, 25-35 (1946).*C. A.*, **41**, 5412d (1947).

The method of "unique points" used in this investigation eliminates the need for standard samples in analyzing ferrous metals spectrographically. The method consists in locating for a given line of the element in question, λ_A , the concns. C_1 , C_2 , C_3 , etc., for which the line has the same d. as the lines λ_{B1} , λ_{B2} , λ_{B3} , etc., of the base metal, B. These values correspond to the "unique points" which are not only equal in d. on the plate but also equal in intensity in the source itself. These points are fixed independently of the spectrograph, the photographic emulsion, and its development. Use of this technique requires that the calibration curve be a straight line and that the base metal be sufficiently rich in lines. Samples of ordinary steel were analyzed both chemically and spectrographically by first using revolving electrodes and second, a counter electrode of Al. Both spectrographic methods gave the same value except for Si and Mn, where a small difference was apparent. This is due to the fact that the arc lines are more dense in the second method than the first when compared to the spark lines because of the diln. of the steel vapor by Al vapor.

2467. AMERICAN SOCIETY FOR TESTING MATERIALS.

American Society for Testing Materials,

Methods of Chemical Analysis of Metals, 1946.

Am. Soc. Testing Mats., Phila., Pa., 402 pp. (1946).*C. A.*, **40**, 7043³ (1946).

Includes methods for the spectrochem. analysis of Zn-alloy die castings, Pb alloys, and Sn alloys for minor constituents and impurities, and of zinc for Pb, Fe, and Cd (cf. *C. A.*, **37**, 6583³).

2468. BAKER, G. AND GASKIN, A. J.

Natural Glass from Macedon, Victoria, and Its Relationship to Other Natural Glasses.

J. Geol., **54**, 88-104 (1946).*C. A.*, **40**, 4986³ (1946).

A small quantity of a natural glass from Macedon, Victoria, is shown to be like Darwin glass from Tasmania. The glasses from both localities are compared and contrasted with natural glass from other parts of the world. The results of secondary fusion of rocks under special circumstances during the fierce burning of tree trunks at two localities in Victoria suggest that these glasses may have developed during forest fires. This casts further doubt on the belief that Darwin glass is of tektitic (extraterrestrial) origin. 14 spectrographic analyses of natural glasses and a no. of chem. analyses are cited.

2469. BAKER, S. C.

Spectrographic Analysis of Steel.

J. Proc. Roy. Soc. N.S. Wales, **80**, 227-36 (1946).*C. A.*, **41**, 6837a (1947).

The prepn. of working curves for spectrochem. analysis of open-hearth steels is described, and various stages of the analytical procedure are discussed. A large quartz spectrograph was used in the work, the samples being arced to completion between specially shaped graphite electrodes on a 300-v. d.-c. line. Si, Mn, Cr, and Mo were detd., the probable error of a single detn. being 5% of the content; P was estd. to within about 10%.

2470. BARNES, R. B., RICHARDSON, D., AND BERRY, J. W.

A Simple Monochromatic Source.

J. Optical Soc. Am., **36**, 52 (1946).*C. A.*, **40**, 1067³ (1946).

An atomizer-flame combination previously described as a flame photometer (cf. *C. A.*, **40**, 25⁸) is slightly modified so that, when viewed through a suitable filter, this flame approximates a very steady monochromatic source that can be used for refractometry, microscopy, and routine spectrochem. analyses.

2471. BERTRAND, D.

New Techniques of Spectrographic Analysis.

Congr. groupe. avance. method. anal. spectrograph. produits mét., **6**, 17-20 (1946).

C. A., **41**, 5411f (1947).

In analyzing for very small amts. of Rb in the presence of K and Na, a method employing a spectrograph and microphotometer is recommended in which the min. error does not exceed a few per cent. The usual method of analysis comprising the striking of an arc between two vertical C electrodes with a hole in the pos. electrode to hold the salt suffers from the facts that the ultimate line of Rb at 4201.8 Å lies in a CN band and the arc is very unstable and wanders so that the light from the luminous zone does not always pass through the slit. These difficulties were minimized by striking the arc between 2 horizontal electrodes enclosed in a small furnace made of refractory earth. A lens of short focal length is used which projects an enlarged image of the arc behind the spectrograph. The best results were obtained with a Fery-type spectrograph. The exposure is made so that the d. falls on the straight-line portion of the H and D curves. Intensities of the background and line plus background are found and subtracted to give the intensity of the line. A Chalgone and Lambert hydrogen lamp is used as an intensity standard. This method gives an accuracy of 3% with 0.002 mg. of Rb in a 10-mg. sample of KCl.

2472. BERTRAND, G. AND BERTRAND, D.

The General Presence of Rubidium in Plants.

Ann. inst. Pasteur, **72**, 416-23 (1946).

C. A., **41**, 5922i (1947).

Sixty plants or parts of plants of 52 species were tested, terrestrial, marine algae, and organic (aspergillus). The Rb was detd. spectrographically, permitting the detn. of 0.5 to 0.0002 mg. Rb in a mixt. of KCl and RbCl₂. In a more complex mixt. it is not as easy to det. the metal in vegetable and therefore it is necessary to eliminate the other metals by analytical methods.

2473. BERTRAND, G. AND BERTRAND, D.

Rubidium in the Cryptogams.

Compt. rend., **222**, 572-4 (1946).

C. A., **40**, 3798⁸ (1946).

The present study includes analyses of 79 species of cryptogams, for Rb content. The plants included 3 marine algae, and 1 fresh water, 60 fungi (basidiomycetes and ascomycetes), 3 lichens, 2 mosses, 7 ferns, 1 club moss, and 1 horsetail, collected from diverse habitats. As a result of these analyses and earlier expts. using 11 cryptogams and 105 phanerogams, the authors favor the conclusion that Rb has a general existence among plants. The results show that cryptogams have an av. Rb content much greater than previously found for phanerogams. The range for phanerogams was 1 to 98 mg. per kg. of dry material, and that for cryptogams was 2.4 to 1510 mg. per kg. The averages were 20 mg. per kg. for the phanerogams and 120 mg. per kg. for the cryptogams. Among the cryptogams the highest Rb content was found in the fungi which had an av. content of 150 mg. per kg. compared with 30 mg. for the other cryptogams. The basidiomycetes (*Costinarius* and *Tricholoma*) contained 18.2-1510 mg./kg. and contained the largest amts. of any of the plants examd.

2474. BERTRAND, G. AND BERTRAND, D.

The Presence and Determination of Rubidium in Arable Soils.

Compt. rend., **223**, 183-5 (1946).

C. A., **41**, 241i (1947).

Chem. and spectrographic analyses confirm the fact that Rb is distributed throughout all plants. Rb is able to exist in soils in a no. of states. The detn. is as follows: a 20-g. sample of fine soil is dried at 105° and ignited gently to destroy org. matter and similar materials. Conc'd. HCl is added and the SiO₂ is sepd. in the usual manner. The SiO₂ residue is extd. with five 20-ml. portions of conc'd. HCl. The exts. and the original filtrate are combined and evapd. to dryness. The spectrographic analyses are made on a HCl soln. of the residue. The Rb content of cultivated soils varies from 1 to 5 mg. per kg. of soil, while the Rb content of 22 European soils taken at random varies from 0.20 to 18.70 mg. per kg. of soil.

2475. BETHUNE, A. Y. AND SCHMITTROT, W. W.

Spectrographic Analysis of Special High-grade Zinc.

Am. Inst. Mining Met. Engrs., Metals Technol., **13**, No. 6, *Tech. Pub. No. 2066*, 13 pp. (1946).

C. A., **40**, 7059⁸ (1946).

The self-electrode method is preferred for the examn. of high-purity Zn contg. less than 0.0025% impurities. A 175-g. Zn electrode is cast in the form of a cone having a disk-like base and a circular tip $\frac{1}{8}$ in. in diam. and $\frac{1}{4}$ in. high, around a C rod inserted halfway into the mold. The rod acts as a support for the electrode during exposure. To minimize

the formation and accumulation of ZnO, an arc operating on a 4.5-amp. 2400-v. closed circuit, 4300-v. open circuit is recommended. The time for the Pb and Fe detn. is 120 sec. with no preburn. The arc is first struck with the analytical gap set at 2 mm., and immediately opened to 4 mm. and kept there for the remainder of the exposure. If Fe is below 0.0002% no line will appear in an exposure of 120 sec. The Cu is made on a new spectrogram with the same electrodes, exposing for 60 sec. through a rotating interrupter set to cut out 75% of the light. The spectral region used for the Cu, Pb, and Fe assays is 5000–2810 Å. If the Cd is 0.0005% or higher it can be detected and measured on the same spectrogram as that from which the Pb and Fe were detd. If the Cd is below 0.0005% fresh electrodes must be used and the spectrograph shifted to the 2850–2200 Å region. The exposure is for 120 sec. with no preburn and no interrupter. For plate calibration Pt electrodes are arced for 10 sec. All exposures are made with the source of light 38 cm. from the slit of the spectrograph, which is set at an opening of 0.025 mm. A Hilger nonrecording microphotometer accommodating a 4- by 10-in. photographic plate is used to measure the d. of the spectral lines. Spectrograms are taken at 3 mm. width for certified assays. The method yields results within $\pm 10\%$ of the amt. of impurity present if the element is in the range of 0.001–0.009% or $\pm 20\%$ if the element is in the range of 0.0001–0.0009%.

2476. BIBIKOVA, V. I.

Rhenium in Dusts of the Molybdenum Division of Balkhash Works.

Tsvetnye Metal., 19, No. 4, 44–8 (1946).

C. A., 41, 1969a (1947).

The Balkhash works (Kazakh S.S.R.) processes Mo ores from Kounrad, Tyznyauz, and Chikoi deposits. The concentrates of these ores contain 0.00012–0.015% Re. The richest in Re are the concentrates of Kounrad ores contg. 0.01–0.015% Re. The concentrates are subjected to an oxidizing roast at 600–700°, in the course of which Re volatilizes and is lost with the furnace gases. Passing the flue gases through an asbestos filter at 200–300° retained 50–4% of the Re. At 450° and higher none of the Re was retained. Passing the gases through a scrubber at the rate of 3–3.51 per min. recovered 6–10% of the Re. A combination of a scrubber and electrofilter retained 86–90% of the Re.

2477. BOEKE, J.

Electrical Measuring Instruments in Chemistry During the War.

Chem. Weekblad, 42, 230–7 (1946).

C. A., 40, 6893² (1946).

A review of modern phys. tools such as app. for: the detn. of dielec. const., emission and

absorption spectroscopy, or electron microscopy.

2478. BOROVIK, S. A. AND BOROVIK-ROMANOVA, R. F.

Effect of Total Composition on the Intensity of Lithium Lines in the Spectrum of a Sample.

Zhur. Anal. Khim., 1, 25–9 (1946).

C. A., 43, 2544h (1949).

The influence of NaCl, KCl, and Cu₂Cl₂ on the spectral line at 6707.7 Å was found to be considerable and high values for the Li content of soil were indicated. In a series of spectra taken from the same sample by shifting the plate every 30 sec. it was found that in case of soil and soil + NaCl, the line 6707.7 Å appears only on the first 3 spectra while in soil + Na₂SO₄ this line appears only in the 4th, 5th, and 6th spectra.

2479. BOROVIK, S. A. AND PROKOPENKO, N. M.

Rare and Disseminated Elements in the Raw Materials, Products, and Refuse of the "Electrozinc" plant.

Compt. rend. acad. sci. U.R.S.S., 51, 523–6 (1946).

C. A., 41, 63g (1947).

A spectroscopic study of the materials, intermediate products, products, and waste of the "Electrozinc" plant in the North Caucasus, which processes Caucasian Pb and Zn ores, was made to ascertain the behavior of the various metals contained in the ores during processing. At present, Ag, Au, Cd, and Bi are obtained commercially as by-products of the treatment of the Zn and Pb concentrates. Other metals accumulate at various stages of the process, and might also be sep'd. profitably. The In in Misury and Kafan Zn ores accumulates in the "secondary Cd sponge"; Co in Misury ore accumulates in the electrolytic solns.; and Sb in the Misury Pb concentrate accumulates in the Pb bullion. Tl was found in the Ritter Zn ore concentrates. The Caucasian ores also contain small amts. of Ga, Sn, Mo, Be, Cr, V, Te, Ge, As, and Ni.

2480. BOROVIK, S. A. AND VOJNER, A. O.

Spectrochemical Analysis for the Estimation of Micro-elements Contained in Ductless Glands.

Byull. Eksptl. Biol. Med., 21, No. 5, 67–70 (1946).

C. A., 41, 5162c (1947).

The activity of the microelements in ductless glands can be traced to the formation of different hormones. This is studied by detg. them in the glandular tissue. However, comparison with their content in the blood indicates the power of the gland to accumulate the microelements in its tissue. Estns. and

detns. were made by spectrochem. analysis. Different ductless glands of 26 persons between 30 and 40 yrs. were used. The glands were dried to const. wt. and heated to not more than 450°. Salts were prepd. for quant. analysis and compared with standards in the spectrograph. The sensitivity of the method is 0.0001–0.001% for Cr, Cu, Ni, Ag, and Bi salts and 0.001–0.01% for Al, Ba, Mn, Pb, Sr, Sn, and Fe. The intensity of the lines gave relative values of the elements in the organs. Qual. study showed that certain elements were evenly distributed in all organs. Ba and Sr were always present. A table shows the content of the different metals in different organs.

2480a. BOROVIK-ROMANOVA, T. F.

Rubidium in the Biosphere.

Trudy Biogeokhim. Lab., Akad. Nauk S.S.S.R., **8**, 145–80 (1946).

C. A., **47**, 7960h (1953).

The following av. concns. of Rb were found: sea water 2×10^{-4} ; marine organisms 3.4×10^{-4} ; soils 6×10^{-3} ; grasses 6.4×10^{-4} ; rivers 1.6×10^{-7} ; fresh-water organisms 2.9×10^{-40} . If concn. of Na is taken as 100, the mineral structures contain 90 parts K and 1.2 Rb; river water carries 33 K and but 0.024 Rb, while sea water had 3 K and 0.0095 Rb. Organisms generally ext. Rb from the environment. Salts of Rb ppt. in marine salt deposits. The detns. were made spectrographically, either flame or arc giving comparable results. Usually Na halides reduce the intensity of Rb lines; although NaF has no effect, KCl has only a weak effect. In final work the source was an acetone lamp or d.-c. arc, since these gave most satisfactory results, with very low concns. The lines used were: 7800.23 and 7947.68 Å. Numerous references.

2481. BRAUDO, C. AND CLAYTON, H. R.

Spectrographic Spark Source.

Nature, **157**, 622–3 (1946).

C. A., **40**, 5304⁷ (1946).

The condensed spark source generally in use for quant. spectrographic analysis is relatively unstable. Two types of excitation circuits of superior stability are described: a high-voltage high-power and a low-voltage controlled a.-c. arc. The controlled-arc circuit permits the attainment of higher analytical accuracy.

2482. CALDECOURT, V. J. AND SAUNDERSON, J. L.

A Combination Arc Spark Source for Magnesium Analysis.

J. Optical Soc. Am., **36**, 99–102 (1946).

C. A., **40**, 2758⁸ (1946).

This paper describes a combined arc and spark source that has significant advantages over the usual high-voltage spark and con-

tinuous arc for Mg analysis. By maintaining the 4 amp. arc $\frac{1}{2}$ of each second, better sampling of the electrodes was obtained without noticeable loss of sensitivity. The spark was constructed so that a condenser of 0.25 μ f capacity, charged to nearly 3000 v., discharged through the spark gap 120 times per sec. This source showed excellent reproducibility and eliminated two troublesome features of the conventional high-voltage spark, viz., shifts in analytical calibration due to changes in absolute humidity and consequent electrical leakage, and radio-frequency disturbance of other sensitive electrical instruments.

2483. CALKINS, L. E. AND WHITE, M. M.

Spectrographic Analysis of Lubricating-Oil Additives, Additive Lubricants, and Gasolines.

Proc. Am. Petroleum Inst., **26**, III, 80–90 (1946).

C. A., **41**, 6395f (1947).

A spectrographic method was developed for the detn. of metals, such as Ba, Ca, Zn, P, and Pb in lubricating-oil additives. The oil samples are absorbed directly in $\frac{1}{2}$ -in. graphite rods, which are then used as electrodes with a grating spectrograph. The av. error for additive oils was 0.002%, and in only one case was the error over 0.01%. The procedure can also be used for detg. PbEt₄ in gasolines.

2484. CAMUÑAS PUIG, A.

Spectrochemical Determination of Beryllium in Very Light Industrial Alloys.

Inform. quim. anal., **1**, 21–3 (1946).

C. A., **41**, 5050a (1947).

Very small concns. of Be cannot be readily detd. by chem. methods, but the spectrochem. method gives satisfactory results. Solns. contg. known amts. of Be(NO₃)₂ in dil. HCl, alone and in mixt. with a const. quantity of Be-free Elektron metal were prepd. as primary standards. Identical quantities of these solns. were placed on pure C electrodes, and the spark spectra photographed side by side under the same conditions. The ratio of the intensity of the Mg line at 2915.5 Å to that of the Be line at 3130.4 Å was plotted on double-log paper against the % Be, and a straight line was obtained. The method, with this diagram, made it possible to select from a stock of alloy samples those that contained the same % Be as the primary standards within an error of 6–12% of the total and to use them as metal electrodes. The necessity of prepg. standards by fusion of the components is thus obviated (cf. *C. A.*, **41**, 4400g).

2485. CAMUÑAS PUIG, A. AND JIMENO MARTIN, L.

- Spectrochemical Determination of Impurities in Zinc of High Purity.
Anales fis. y quim. (Madrid), **42**, 1053-64 (1946).
C. A., **41**, 5055b (1947).
- ZnO was mixed with an equiv. mol. wt. of dry NH_4Cl . The arc was obtained with 10 amp., instead of the usual 5 amp., and was flaming. In this way it is possible to compare the ds. of blackening of the Zn lines with those of the metal impurities and maintain lineal relation of logs of relative intensities of radiations and logs of concns. of impurities within wide limits. The effect of depth (background) and bands from CN are considerably reduced. There was no fractional distn. Spectrograms are obtained rapidly; time of exposure is only 5-7 sec., whereas normal exposure is 2-5 min. 16 references.
2486. CARBOCCI, G. AND PIERUCCINI, R.
 Spectrographic Analysis of Elban Tourmaline. Relation of Color to Composition.
Ricerca sci. e ricostruz., **16**, 1466-7 (1946).
C. A., **46**, 10061f (1952).
 See *C. A.*, **41**, 3716e.
2487. CARPENTER, R. O'B.
 A New Balancing Circuit for the Nonrecording Densitometer.
J. Optical Soc. Am., **36**, 576-8 (1946).
 The application of the electron-multiplier photo tube and the light-chopping method to the design of a densitometer is described. The techniques are generally applicable to the measurement of very low light intensities.
2488. CASTRO, R.
 The Spectrographic Determination of Low Concentrations of Aluminum in Ordinary and in Special Steels.
Metal Treatment, **1946**, 182-96.
Congr. groupe, avance, méthodes anal. spectrograph. produits mét. **5**, 17-33; discussion, 34-6 (1946).
C. A., **40**, 7048⁷ (1946).
 The chem. detn. of small amts. of Al (less than 0.10%) added to steel to control the size of austenitic grain is a long and delicate process. The 8-hydroxyquinoline method gives accurate results for C steel but not for steels contg. Cr and V. A spectrographic method of detg. Al in steel is described; it employs a Zeiss Q 24 spectrograph, a 12,000-v. spark, cylindrical electrodes of 3.5 mm. diam. and photoelec. densitometer. The following Fe/Al intensity ratios were measured: 3945.13/3944.03 for Al content under 0.035%, 3963.11/3961.53 for the same range of Al in C steel, 3935.81/3944.03 for Al between 0.030 and 0.080%, 4014.53/3961.53 for Al around 0.100 to 0.150%. The av. abs. error in the detn. of 0.004 to 0.025% Al in steel is $\pm 0.0006\%$, and in the range 0.025 to 0.150% Al it is ± 2.5 to 5%. These figures are for a single detn. and are divided by 1.4 or 1.7 when the result is the mean of 2 or 3 observations. When high concns. of Al are present errors resulting from segregations are avoided by sparking hydrochloric solns. from which the major content of Fe has been removed by ether treatment.
2489. CHOLAK, J. AND HUBBARD, D. M.
 Microdetermination of Mercury in Biological Material.
Ind. Eng. Chem., Anal. Ed., **18**, 149-51 (1946).
C. A., **40**, 2180¹ (1946).
 Spectrographic procedures always resulted in a loss of Hg and were therefore abandoned in favor of the chemical method described.
2490. CLAYTON, H. R.
 Light-integrating Exposure Switch for Spectrographic Analysis.
J. Sci. Instruments, **23**, 233-4 (1946).
C. A., **41**, 1153b (1947).
 The light-integrating exposure switch described consists of an optical system and elec. circuit. After a pre-sparking period fixed by a synchronous time switch, light from the source falls on a photocell through which a condenser charge is dissipated until a pre-set value is reached at which the discharge circuit is broken.
2491. COHEUR, P.
 A Method of Quantitative Spectrochemical Analysis Based on Line Widths.
J. Optical Soc. Am., **36**, 498-500 (1946).
C. A., **40**, 7043⁸ (1946).
 A method of quant. spectrochemical analysis, first suggested by Gerlach and Rollwagen (*C. A.*, **32**, 52¹), making use of line widths, is described and discussed. Instead of detg. the intensity ratio of a matrix or internal standard line and an impurity line, this method measures the width of the former line at an opacity (or galvanometer deflection) corresponding to the max. opacity of the latter. Expts. are reported to prove that this photometric width is independent of the duration of exposure and of the conditions of photographic development, not only in the linear part of the HD curve but also in regions of under- and over-exposure. Calibration curves showing the log of the concn. of the impurity as a function of the photometric width are prepd. from standard samples. Examples are given of Mn in Fe and of Mg in Al. The method is advantageous for the detn. of concns. exceeding 5%. The error of a detn. based on width measurement is usually less than that from an intensity ratio.
2492. CONVEY, J.
 History and Present Status of Emission Spectroscopy as Applied to Industry.

Metallurgia, **34**, 331 (1946); **35**, 9-12, 107-10 (1946).

C. A., **41**, 1553f (1947).

Various prismatic and grating spectrographs are described. Modern grating spectrographs differ solely in their type of mounting and various mech. adjustments. The development of controlled light sources is discussed, and the photometry and calibration of spectrograms are described. Spectral excitation methods have improved and photo-multiplier tubes with greatly increased sensitivity have become commercially available. Methods of using these tubes are discussed. 51 references.

2493. CORLISS, C. H. AND SCRIBNER, B. F.
Spectrographic Determination of Boron in Steel.

J. Research Natl. Bur. Standards, **36**, 351-64 (1946).

C. A., **40**, 5354² (1946).

FeB is sometimes added to steel in the ladle or ingot molds in order to increase the hardenability (depth of hardening), which requires only a few thousandths of 1% B. The quantity of B present is near the limit of spectrographic detn. The strongest B line, at 2497.7 Å is too close to the Fe line at 2497.8 Å, so that the next strongest line at 2496.8 Å is used. The sensitivity and accuracy with which the B can be detd. is affected by variations in the rate of cooling. With $\frac{3}{8}$ -in. rod electrodes, as little as 0.0006% B can be detd. within about 4% of the truth. With more massive specimens, the high-voltage, a.-c. arc is insensitive but an over-damped condenser discharge or similar source provides adequate sensitivity and precision. As little as 0.0001% B can be detd. with a d.-c. arc to which Na is added to suppress an interfering Fe line at 2497.8 Å. In the present study B-steels in $\frac{3}{8}$ and $\frac{1}{2}$ -in. rods were studied through the range 0.0006 to 0.019 % B.

2494. CORNU, A.

New Arrangement for Quantitative Spectrography.

Compt. rend., **222**, 1341-2 (1946).

C. A., **40**, 5657⁸ (1946).

The same generator is used to operate two sparks, one of a standard alloy and the other, the unknown sample. A suitable optical system is used to project both spectra on the same photographic plate, one being slightly displaced with respect to the other. The slit of the spectrograph is replaced by a sharp reflecting cylinder, giving the effect of two slits, each illuminated by a single spark. There are many advantages of this arrangement, including elimination of errors due to variation of sensitivity of plate with wave length, irregularities in the emulsion; ease of analysis due to proximity of the standard

spectrum; elimination of errors resulting from unequal exposure times.

2495. CRAGGS, J. D. AND HOPWOOD, W.

Observation of Spectral Lines with Electron Multiplier Tubes.

Nature, **158**, 618 (1946).

C. A., **41**, 1553e (1947).

Developments in the Metropolitan-Vickers labs. since 1943 on sources for spectroscopic work, the detn. of ion concns. in the H spark discharge, and observations of the excitation of metal electrode vapor in spark discharges are summarized. A photographic reproduction of the oscillograph screen is given for the spark-excited Cd line 5085 Å; the pulse is 4 microsec. long, and is, therefore, that of a pure spark source. The control of energy fluctuations is discussed.

2496. CROISSANT, P.

The Determination of Traces of Impurities in Zinc Alloys by Means of the Condensed Spark.

Congr groupe avance méthodes anal. spectrograph. produits mét., **5**, 65-8 (1946).

C. A., **40**, 7070² (1946).

A quartz spectrograph and 11,500-v. condensed spark were employed for the detn. of impurities in Zn alloys. It was found that sensitivity was increased by adding capacitance, and background was reduced by increasing inductance in the discharge circuit. With capacitance of 7000 cm. and self inductance of 3.7 millihenrys the Pb line 2833 Å and Cd line 2288 Å were detected at concns. of 0.003%, and the Sn line 2840 Å was detected at less than 0.001%. The av. error in the detn. of Pb was $\pm 3\%$ in the concn. range from 0.004 to 0.030%.

2497. DRÁN GUELBEZU, M., LOPEZ DE AZCONA, J. M., AND SANTOS RUIZ, A.

Trace Elements in Spanish Foods of Vegetable Origin. II. Garden Vegetables.

Anales fis. y quim. (Madrid), **42**, 508-15 (1946).

C. A., **41**, 5648h (1947).

Among 47 products examd., Ag was found (10^{-4}) only in the field mushroom (*Agaricus campestris*). Ba lines appeared in the spectra only as ghosts; thus none of the samples contained Ba in a proportion as great as 10^{-4} . Co was found in one sample of the group consisting of chicory, artichoke, thistle, endive, periwinkle, cauliflower, red cabbage, turnip, cabbage, and in 3 samples of asparagus. Cu, Fe, Li, Mn, Si, and Ti were in all samples. Mo was in the fruits of all cucurbitaceae. Ni occurred in the ash of all samples. Pb varied greatly; it was highest in asparagus. Sn was in only one sample, probably from the can. V appeared in 14.8% of the samples.

2498. DEÁN GUELBEZU, M., LOPEZ DE AZCONA, J. M., AND SANTOS RUIZ, A. Trace Elements in Spanish Foods of Vegetable Origin. V. Tubers, Seeds, and Dried Fruits.

Anales. fis. y quim. (Madrid), **42**, 833-42 (1946); cf. *C. A.*, **41**, 5649ac.

C. A., **43**, 4395c (1949).

The ash of a no. of species was examd. spectroscopically.

2499. DEINUM, H. W.

The Purification of Carbon Rods for Spectrochemical Analysis.

Rec. trav. chim., **65**, 270-2 (1946)(in English).

C. A., **41**, 3f (1947).

It has been found that the temp. cannot be increased at will by applying a higher voltage (and thus a larger current). If this is done, observations show that when the current reaches its max. value (660 amp.), the rod breaks or explodes violently. The explanation for the explosion is that the center of the rod is considerably higher than the surface in temp. The tube was heated by the passage of an elec. current. The temp. inside the tube and that of the surface were then measured alternately. The temps. in °K. were: 2220 (inside), 2190 (outside), 2190, 2180, 2150, 2120, 2060, 2080, 2005, 1990. The result is that the radiation coeff. can be taken practically equal to 1.0. The temp. of the rods was measured. This temp. can be approx. calcd. from the loading in w. per sq. cm. of the surface by means of the radiation formula: Radiation in w./sq. cm. = $5.736 \times 10^{-12} \times T^4$.

w./sq. cm.	Temp. obsd.	Temp. calcd.
195	2480	2415
290	2690	2665
430	3060	3045
600	3200	3200
780	3450	3415
940	3430	3580

When the load becomes greater than about 750 w./sq. cm., the temp. no longer rises. The surface does not become hotter than 3450°K.

2500. DIEKE, G. H. AND CROSSWHITE, H. M. Spectrochemical Analysis with the Oscillograph.

J. Optical Soc. Am., **36**, 192-5 (1946).

C. A., **40**, 4290⁶ (1946).

An application of spectrograph, photomultiplier tube, and oscillograph to almost instantaneous chem. analysis is illustrated by the detn. of Cu, Mn, and Cr in iron and steel.

2501. DIEKE, G. H., LOH, H. Y., AND CROSSWHITE, H. M.

Spectral-intensity Measurements with Phototubes and the Oscillograph.

J. Optical Soc. Am., **36**, 185-91 (1946).

C. A., **40**, 4290⁶ (1946).

The instantaneous elec. and spectral emission characteristics of discharge tubes, sparks, and d.-c. arcs are explored by employing a stigmatic 21-ft. diffraction grating, a photomultiplier tube, and a cathode-ray oscillograph. The results are of interest in spectrochem. analysis because they indicate that spectral-line intensities may vary irregularly even though a const. current is maintained in the light source.

2502. DULL, B. B. AND HIBBERT, L. J.

Spectrochemical Analysis of Lead-Base Metals.

J. Optical Soc. Am., **36**, 53-6 (1946).

C. A., **40**, 1422⁷ (1946).

A rapid procedure is described for the spectrographic determination of Sn and Sb in 3 types of type metals, by using a flat-surface sparking technique, a commercial high-voltage spark unit, and grating spectrograph. Working curves have been drawn from prepared standards in disk form to cover 4-10% Sn and 10-20% Sb. Several line pairs were studied, but the best results were obtained with Sn 2335/Pb 2332 and Sb 2683/Pb 2332 Å. The best reproducibility was obtained with a hemispherically shaped cone on the graphite counter electrode. The method proved satisfactory for the routine control of the composition of type metal.

2503. EASTMOND, E. J.

Spectrographic Determination of Calcium in Microbiological Culture Media.

J. Optical Soc. Am., **36**, 57-60 (1946).

C. A., **40**, 1556⁸ (1946).

To determine the Ca content of asparagus-butt juice medium spectrographic analysis was applied. Samples were charred directly on C electrodes, burned in a 250-v. d.-c. arc carrying 15 amp. and the spectrum was photographed with a Littrow quartz spectrograph. Sr was added to supply an internal standard and the analysis pair Ca II 3179.33/Sr II 3464.46 Å was used. In order to compensate for possible variations in the major inorganic constituents of the medium, a buffer of KCl or KH_2PO_4 was added to the sample. The chief problem was to prepare standards that could be treated similarly since no samples of culture media free of Ca were available. This was solved by removal of Ca from the actual medium by use of a cation-exchange column of Amberlite 1R-100 operated in a K cycle. Five standards were prepared from this treated medium by adding 25.6-1000γ of Ca per ml. Analyses showed a standard deviation of 1.8% and maximum of 3.3%.

2504. EWLES, J. AND CURRY, C.

Note on Quantitative Spectral Analysis of Solutions Available in Very Small Quantities Only.

Proc. Leeds Phil. Lit. Soc., 4, 299-302 (1946).

C. A., 42, 2203e (1948).

Two procedures are described for making quant. spectrochem. analyses of solns. available in very small amts. (1) A small cup, 0.1-cc. capacity, is made from thick-walled capillary tubing, 3-mm. bore, with a Pt lead-in wire sealed into the bottom. When filled with the soln. to be analyzed this cup serves as lower electrode for a spark discharge between it and an upper electrode of Pt wire. (2) In place of the glass cup a tight roll of filter paper, 4-mm. diam. and 1 cm. long, is substituted. Enough soln., about 0.25 cc., is added to sat. the paper. With a suitable discharge circuit the required exposure times are of the order of 1 or 2 sec. Illustrated with solns. contg. 10-40 mg. of Ca in 100 cc.

2505. FAST, E.

The Effect of Plate Calibration Errors in Spectrographic Analysis.

J. Optical Soc. Am., 36, 424-6 (1946).

C. A., 40, 5351⁴ (1946).

In the internal-standard method of spectrochem. analysis the concn. of an element is detd. from the ratio of the intensity of a line of the element to that of a standard line, emitted either by the matrix or by an added element. The intensities of spectral lines are generally measured photographically, which necessitates accurate calibration of photographic emulsions. A detailed analysis is given here of the case that a wrong calibration curve is used in detg. the line intensities.

2506. FLORENCE, G.

Spectrography in Biology.

Exposés annuels biochim. méd., 6, 15-72 (1946).

C. A., 45, 9583g (1951).

A review on theory, methods, and application of emission and absorption spectra in biol. and clinical chemistry. 236 references.

2507. GATTERER, A. AND FRODL, V.

Spectrochemical Detection and Determination of the Halogens and Other Non-metals by Ultra-high-frequency Excitation.

Ricerca spettroscop., 1, 201-44 (1946)(in German).

C. A., 40, 7062⁷ (1946).

A Siemens-Reiniger radio-therapy outfit with an output of 600 w. at 3-8 m. was used to excite an electrodeless discharge. Ten-mg. portions of solid alkali halides, Se, S, or other volatile substances were carefully dried,

placed in a boat, and placed in the emission tube. The latter was then completely evacuated, flamed, and the ultra-high-frequency field applied. Exposures lasted 30-120 sec.; only the region 4100-7100 Å was covered. Blank runs showed lines of H, Hg, O, Na, N₂, C₂, Co⁺, CN, and CH, tables of which are given, but these lines practically disappeared in the presence of samples. The broadcast energy sufficed both to volatilize the sample and to excite the vapors. The low ionization potentials of the alkali metals did not prevent the obtaining of halogen lines; the following sensitivity limits, accurate to $\pm 5-10\%$ were obtained: 0.03% Br as KBr in NaCl; 0.01% I as KI in NaCl; 0.1% Cl as NaCl in KBr; 0.1% S as K₂SO₄ in KCl. Detection limits lay 3- to 10-fold lower. Wavelengths and raies ultimes are tabulated for Cl, Br, Se, and S, and for the most prominent alkali lines appearing in these spectra.

2508. GEGECHKORI, N. M., EDNERAL, T. B. AND MANDEL'SHTAM, S. L.

The Effect of Third Elements in the Spectroanalysis of Steel.

Zavodskaya Lab., 12, 559-68 (1946).

C. A., 41, 1950g (1947).

Results of expts. with low-alloy steels indicate that 3rd elements have no effects on detg. Cu, V, Ni, and Si. Three samples contg. Si approx. 1.0-1.5% and Mn approx. 0.5% (Mn 1.00, Si 1.08, Ni 0.11, and Cr 0.95%; Mn 1.01, Si 1.58, Ni 0.10, and Cr 1.39%; C 0.30, Mn 1.48, Si 1.61, Cu 0.08, Ni 0.04, Cr 0.15, V 0.02, and Mo 0.21) indicated a definite effect of Si on the detn. The curves of these samples did not coincide with those of other samples. Possibly approx. 1.0-1.5% of Si affects the detn. of Cr in steel contg. 0.5% of Cr. Most samples of high-alloy steels showed considerable effects of 3rd elements. Four references.

2509. GÖSSLER, F.

New Spectrographs for Spectrochemical Analyses.

Optik, 1, 85-133 (1946).

C. A., 41, 5759g (1947).

It is claimed that it is not necessary to use an app. of high dispersion and resolving power for examg. multilinear spectra (e. g., steel). It is possible to make a quant. as well as qual. examn. of nearly all kinds of steel, light metals, and alloys, with the "Q 12" spectrograph; only Nb and Ta cannot be detd., and some difficulty is found with Si-, V-, and W-contg. steels. A higher-dispersion instrument is recommended for the rare earths and ores. Glass prisms are suitable for steel analyses, but with loss of sensitivity of the photographic plates. By use of a Steinheil G. H. Zeiss 3-prism spectrograph this dis-

advantage is minimized. Many spectral-line tables and diagrams are given.

2510. GRIFFITH, L. AND KIRKBRIDE, J. N.
Internal Standard Method of Spectrographic Analysis as Applied to the Determination of Lead in High-Purity Zinc. *J. Soc. Chem. Ind.*, 65, 39-48 (1946). *C. A.*, 40, 3693^a (1946).

In electrolytic Zn, some Pb is introduced into the otherwise-very-pure metal from the anodes and it is necessary to det. the Pb daily as it is necessary to keep the Pb content below 0.003%. The Bi line at 2897.98 Å can be compared with the Pb line at 2833.07 Å photometrically. In prepg. the product, the Pb is run as close to 0.003 as is safe and, therefore, the spectrographic result must be close to the truth. A full account of all the necessary details is given.

2511. GYÖRGY, V.

Photometric Flame Determination of Potassium by the Nehring, Schachtschabel and Riehm Methods.

Mezőgazdasági Kutatások, 17, 95-104 (1944). *Chimie & industrie*, 56, 413 (1946). *C. A.*, 41, 5244e (1947).

K can be detd. rapidly and simply by Nehring's (*C. A.*, 38, 1061^a) and Schachtschabel's (*C. A.*, 38, 2152^a) methods, which properly indicate the changes in K content produced by the addn. of fertilizers. The small quantities of Ca, Mg, and Na found in the soln. have but little effect on the results and their action can be compensated by addn. of NH_4 phosphate. Photometric examn. by means of the Zeiss model of the Schuhknecht and Waibel app. has been facilitated by the use of a mirror instead of a needle galvanometer, the former being 10 times as sensitive with a medium opening and a 50-v. emf. applied to the photoelec. cell. Comparison of the Nehring and the Aspergillus methods gave agreeing results when the factor " $Z \times \text{MgK}_2\text{O}/100 \text{ g. soil}$ " was applied to the results found by the Nehring method. The Riehm method (*C. A.*, 29, 7218¹), on the other hand, did not give the expected results; the K content is barely measurable even with the mirror galvanometer, and variations in the K content cannot be detected.

2512. HASLER, M. F., KEMP, J. W., AND DIETERT, H. W.

Spectrochemical Analysis of Steel with a Direct-reading Instrument.

ASTM Bull. No. 139, 22-5 (1946). *C. A.*, 40, 3697^a (1946).

Mn, Ni, Cr, Mo, V, Si, Cu, and Sn in refined or low-alloy steels can be detd. advantageously with a direct-reading instrument. The installation consists of (1) a special spectrometer contg. up to 12 light receivers,

(2) a recording console with a recorder for each receiver, and (3) a source unit providing means for exciting a high-intensity spectrum of the sample under a variety of excitation conditions. Such an installation with a grating spectrometer is described.

2513. HEIDEL, R. H.

Direct Photoelectric Spectrochemical Determination of Exchangeable Bases of Soils.

Proc. Iowa Acad. Sci., 53, 211-23 (1946). *C. A.*, 42, 4298i (1948).

Simultaneous analysis of the Ca, Mg, Na, K, and Mn in the exchangeable base series is accomplished by combining the use of conventional spectrographic methods and instruments with the methods of flame photometry (*C. A.*, 40, 25^a, 2083^a). Mg was detd. at 2852 Å and at triplet lines 4031-3-4 Å for Mn. The spectral region for the Li internal standard line at 6708 Å was isolated by use of glass filters Wratten Nos. 70 and 35 and Corning No. 9780. Ca spectral lines at 6182 Å and 6203 Å were isolated with Corning Nos. 5120, 9780, and 2412 filters, K at 7665 and 7699 Å with Corning Nos. 2403, 5850, and 5031, and Na at 5890 and 5896 Å with Wratten No. 25 and Corning Nos. 3387 and 5031 filters. App. used is described. Working curves in milliequivs. per 100 g. of soil plotted against bridge readings or ratios of photocurrents were prepd. for Ca in a concn. range from 2.0 to 15.0, for Mg from 0.50 to 8.0 for K from 0.10 to 0.60, and for Na from 0.10 to 1.0. The Li internal standard was in a concn. of 2000 ppm. For the 48 analyses of the standards for working data the av. deviation from the standard was 5.1 for Ca, 8.7 for Mg, 4.8 for K, 21.6 for Na, and 24.9% for Mn.

2514. HODGE, E. S.

Collected Abstracted Published in 1945 on Spectrochemical Analysis.

Ohio Valley Spectrographic Society, 1946, 64 pp.

C. A., 40, 6024^a (1946).

2515. HOOGLAND, P. L.

The Purification of Carbon Rods for Spectrochemical Analysis. I. Apparatus for Purification by Means of Resistance Heating.

Rec. trav. chim., 65, 257-64 (1946) (in English).

C. A., 41, 2h (1947).

C rods can be purified by heating them to a very high temp. by the passage of an elec. current. (The temp. should be higher than 2000°.) Preuss method: C rods 350 mm. long and 5 mm. in diam. are heated in a vertical position by a current 180-200 amp. max. for 2 min. Gatterer's method: C rods 1400

mm. long and 5 mm. in diam. are heated for 10-20 sec. with a current of 300-320 amp. Max. purification of C rods was obtained by turning on current at 170 amp., then increasing it to 300-320 amp., then gradually decreasing it to 270 amp. During the heating a weak current of air was blown along the rod to obtain a uniform heating and a homogeneous final product. The following regulations must be observed: (1) The heating must take place at the highest possible temp., since the purification will be complete in each case. (2) The heating time must be short in order to avoid burning away the rods. (3) The purity of the final product must be so high that analyses carried out by the cathode-layer method can be carried out with that product as supporting electrode. It was found that products with sufficient purity could be obtained by heating for 60 sec. with a max. current of 650 amp. (17 amp./sq. mm.).

2516. HULDT, L.

The Influence of Foreign Elements on the Intensity of Spectrum Lines in the Flame of Acetylene.

Arkiv Mat., Astron. Fysik, A33, No. 5, 22 pp. (1946).

C. A., 41, 913e (1947).

The Lundegårdh acetylene burner and the method of quant. spectral analysis are described. A condition for the practicability of carrying out a quant. analysis is that the intensity of a spectrum line is a function only of the content of the element concerned. This is not fulfilled, if foreign elements disturb the emission. A few examples of such disturbances of intensity are given. The weakening of the Ca resonance line by Al and the strengthening of the Sr resonance line by Ca are dealt with more closely; these being the most important cases. A survey is given of the processes leading to light-emission by the flame. The quantities detg. the intensity of a spectrum line are, besides the concn., degree of dissocn., excitation, and degree of ionization. The possibilities are discussed that these quantities may be disturbed by foreign elements. Ionization disturbances can be distinguished by absorption measurements or the inversion method. The theory of spectrum line-inversion is developed. This gives a direct measure of the degree of excitation temp. even for an inhomogeneous flame. The line-inversion procedure is described. As the disturbance of Sr by Ca occurs at very minute Sr concns. a special app. was used composed of a burner with 10 flames and 2 mirrors which further tripled the absorption path. It was found that the excitation remained unchanged in both disturbances investigated. The temp. in the flame was detd. by the inversion procedure. The value found was $2670 \pm 40^\circ\text{K.}$

with Ca and Sr as well as Li. The change in the chem. state in the Ca-fed flame caused by addn. of Al., as established by inversion measurements, was studied more closely by investigating the intensity of the band spectra. The results appeared to indicate the formation of a radical contg. Ca and Al. However, no spectrum of a newly formed mol. could be observed.

2517. HURST, J. E. AND RILEY, R. V.

Routine Spectrographic Analysis of Cast Iron.

J. Iron Steel Inst. (London), Advance copy, June, 1946, 12 pp.

Can. Metals Met. Inds., 9, No. 8, 23-9 (1946).

C. A., 40, 6364² (1946).

Spectrographic technique is ideal for the rapid estn. of all elements except C, S, and P in plain and alloy cast Fe. The method is similar to Barker's flat-surface technique for steel (C. A., 33, 5314⁸). All major metals are estd. from one exposure. 6 references.

2518. ITSIKSON, M. I. AND RUSANOV, A. K.

Indium in the Tin Ore Deposits of the Far East.

Compt. rend. acad. sci. U.R.S.S., 53, 631-2 (1946)(in English).

C. A., 41, 2661g (1947).

Spectrographic analysis proves the presence of In in 72 cassiterite specimens, especially from the Mikoyan deposits.

2519. ITSIKSON, M. I. AND RUSANOV, A. K.

Scattered Elements in Cassiterite Deposits of the Far East (According to Spectral-Analytical Data).

Izvest. Akad. Nauk S.S.S.R., Ser. Geol., 1946, No. 5, 119-30.

Chem. Zentr., 1947, I. 1168.

C. A., 43, 6123i (1949).

The results of spectral analyses on 72 samples from 21 Sn deposits are reported. V was found in 67 samples in amts. of 0.001-0.01%, Cr was found in 5, and Mo in about 20 in amounts of 0.001-0.01%. The W content was 0.1-1.0%. Cb and Ta occurred with pegmatite in amts. up to 1.0%. Pb, Ga, and In were always found; Ag, Bi, Sb, Cb, Ta, and Cu were less frequently found; Ni, Co, As, Zn, and Be were seldom found; and Hf, Tl, Cd, and Cr were still less frequently found. In comparison with other Sn deposits of Russia, those of the Far East are distinguished by the fact that Pb, Ga, In, V, and W are always present and Ge is absent. Mo is typical for pegmatite, less so for the sulfide-cassiterite deposits. Higher concns. of W, In, and Co occur in the latter.

2520. IVANOV, S. N.

Indium-bearing Greenockite from the Sibai Pyrite Deposits in the Urals.

Compt. rend. acad. sci. U.R.S.S., **54**, 619-22 (1946) (in English).

C. A., **41**, 6495f (1947).

Spectroscopic analyses of the greenockite gave medium strength lines of In. Mineralogical data, with somewhat detailed crystallography, are given.

2521. IVANOVA, E. N. AND PATRIN, M. Y.

A Spectral Method for Grading 30 KhGSa and 35 KhGSa Steel.

Zavodskaya Lab., **12**, 509-10 (1946).

C. A., **41**, 1173g (1947).

The 30 KhGSa and 35 KhGSa steels differ in their contents of C, S, P, Ni, Cr, and Si. The method described is based on the spectral detn. of Cr and Si in the samples. The following lines were used in detns. of Cr: Cr 4646 Å (1), Cr 4651 Å (2), Cr 4652 Å (3), Fe 4643.5 Å (4), Fe 4647.4 Å (5), and Fe 4654.6 Å (6). The relations between the intensities of the Cr and Fe lines were: $1 < 6$ and $3 < 5$ for Cr concns. of 0.80-1.00%; $1 = 6$ and $3 \geq 5$ for Cr concns. of 1.00-1.20%; $1 \geq 6$, $2 < 5$, and $3 > 5$ for Cr concns. 1.20-1.40%; $3 \leq 6$ for Cr concns. of 1.40-1.60%. The following lines were used in detns. of Si: Si 3905.52 Å, Fe₁ 3902 Å, Fe₂ 3903 Å, and Fe₃ 3906 Å. The relations between the intensities of the Si and Fe lines were: Si < Fe₂ for Si concns. of 1.0-1.2%; Si $\geq$ Fe₂ for Si concns. of 1.3-1.5%; Si = Fe₃ for Si concns. of 2%. The spectral method on the steeloscope is not very accurate, but it is sufficient for mass sorting of steel objects. The deviations of results reached 20-5% (relative)

2522. KAZAKOVA, M. E.

Bismuth from the Emerald Mines of the Urals.

Compt. rend. acad. sci. U.R.S.S., **54**, 623-4 (1946) (in English).

C. A., **41**, 6495d (1947).

Native Bi is found in pegmatites and is usually assocd. with plagioclase, quartz, fluorite, molybdenite, beryl, and chlorite. The native Bi is of later formation than plagioclase, beryl, and some modifications of quartz, the time of its segregation approaching in many veins that of molybdenite. The pegmatite melt soln. was characterized by a low S content. Bi usually forms scales and irregular segregations 0.1-0.6 cm. in diam.; of less frequent occurrence are crystals with poorly expressed crystallographic forms, up to 2 cm. in diam. Its color is silver-white; frequently tinting is observed. H = 2.5; sp. gr. 9.266 (dett. by pycnometer). Chem. analysis: Bi 95, Te 2.31, Fe 0.02, Ni 0.87, S 0.80%; Se, Si, Ca, and Mg are

absent. Spectroscopic analysis shows lines for: Be, Ag, Pb, Sb, Mg, Mn, Ca, Si, Ti, and rare earths (weak lines). An outline of methods used in the chem. analyses is given.

2523. KHRSHANOVSKIY, S. A.

Instruments for Spectroanalysis Manufactured by the OGPU Factory.

Zavodskaya Lab., **12**, 620-3 (1946).

C. A., **41**, 1894c (1947).

The paper describes a quartz spectrograph, a microphotometer, a spectroprojector, and a measuring microscope. Five references.

2524. KIESS, C. C., HUMPHREYS, C. J., AND LAUN, D. D.

Preliminary Description and Analysis of the First Spectrum of Uranium.

J. Research Natl. Bur. Standards, **37**, 57-72 (1946) (Research Paper No. 1729).

C. A., **40**, 6987^r (1946).

More than 9000 wavelengths with estd. intensities have been measured for U I lines in the region 2900-11,000 Å. A few of these lines exhibit well-resolved Zeeman effects when excited in magnetic fields up to 35,000 oersteds. The *g*-values detd. therefrom give the identification of some of the low and metastable energy levels of the neutral atom as components of odd ⁵L, ⁵K, ⁷M, and ⁷K terms arising in the electron configurations *f³ds²* and *f⁴d²s*. About 2000 of the U I lines have been classified as combinations between 18 low odd levels with about 280 high even levels. The binding of 5*f* electrons in the valence group of the neutral U atom stamps it as of the rare-earth type, homologous to Nd, and the 3rd member of a 2nd group of rare-earth elements beginning with Th. The ionization potential estd. for neutral U atoms is approx. 4 v.

2525. KING, C. M.

A Lens to Supplant the Spectrograph Slit.

J. Optical Soc. Am., **36**, 164-8 (1946).

C. A., **40**, 2742ⁱ (1946).

On the theory that the conventional spectrograph slit could be exactly replaced by a narrow image a concave cylindrical lens of about 5 mm. focal length has been used to form a virtual image of the light source. By using a width-limiting aperture and a condensing lens to insure that the aperture is filled with light, spectral lines of definite and reproducible profile are obtained with widths depending on the position of the width-limiting aperture. The following advantages are claimed for this pseudo-slit: simplicity of manuf., durability, ease of maintenance for extremely narrow lines, and max. light efficiency.

2526. KNORRING, O. V.

A Manganese Garnet Enclosed in Sphalerite from Kimito in S. W. Finland.

Compt. rend. soc. géol. Finlande, No. 19;
Bull. comm. géol. Finlande, No. 138,
77-87 (1946) (in English).

C. A., 41, 1181a (1947).

Spessartite intergrown with sphalerite in a cavity in quartz from the pegmatite quarry at Rosendal, Kimito is described. Chem. and spectrographic analyses of the sphalerite and spessartite are given. The ZnO content of the latter was less than 0.01%. v. Knorring's results verify the assumption that Zn only with difficulty can enter the garnet lattice, especially spessartite.

2527. LAB, R. F.

Rapid, Accurate, Economic Analysis of Iron and Steel by Means of the Spectrograph.

Blast Furnace Steel Plant, 34, 1509-14 (1946).

C. A., 41, 925i (1947).

A description of the equipment used for either arc or spark and the procedures followed. Microphotometers are used for plate reading. The spectrographic method is satisfactory for the economical detn. of all elements except C, P, S, N, H, and O in pig Fe, cast Fe, converter metal, open-hearth, and elec. furnace steel. Accuracy is comparable and in many cases better than by wet chem. methods.

2528. LARRIBU, L.

Spectrographic Analysis of Zinc-Base Alloys.

Ind. Eng. Chem., Anal. Ed., 18, 403-7 (1946).

C. A., 40, 4978¹ (1946).

Satisfactory lines are Zn, 2670; Cd, 2288; Pb, 2833; Mg, 2928.7; Fe, 2967; Al, 3060; Sn, 3175; Cu, 3194 Å. By studying the photographs of these lines, 0.002-0.015% Pb, 0.002-0.010% Cd, 0.002-0.015% Sn, 0.01-0.10% Mg, 0.01-0.10% Fe, 0.75-3.25% Cu, and 3.5-4.5% Al can be detd. with reasonable accuracy. A special electrode packed with NH_4Cl , together with a flat-disk Zn electrode, is recommended. The use of the packed electrode is probably new for the spark method of analysis, although it has been used previously in other methods of spectral analysis.

2529. LEVY, S. AND CHRISTINE, O. W.

The Use of Heterochromous Lines in Spectrographic Photometry.

J. Optical Soc. Am., 36, 503-6 (1946).

C. A., 40, 6997⁴ (1946).

The spectral lines used as "working pairs" in spectrographic analysis are as a rule of a

small wavelength difference. The main reason for this is that the characteristic curves of the photographic plate usually vary with the wavelength. The inconvenience of this restriction in the choice of lines is obvious, particularly in the analysis of nonferrous metals when the no. of suitable lines is limited. It might be desirable therefore to know just how much a large $\Delta\lambda$ could affect the reliability of the analysis in a given case. For this purpose, the relationship between the transmittances of spectral lines of a large $\Delta\lambda$ must be investigated as a function of exposure and plate contrast. The results of such an investigation for a particular case made with Eastman Kodak Spectrum Analysis No. 1 plates are given here. A procedure based upon this relationship is described; this permits the use of lines of a large $\Delta\lambda$ when no other suitable lines are available.

2530. LOEUILLE, E.

Comparative Luminosity of the Zeiss Qu 24 Spectrograph and the Zélande Spectrograph of Jobin and Yvon.

Congr. groupe, avance. method. anal. spectrograph. produits mét., 5, 46-64 (1946).

C. A., 40, 6996⁹ (1946).

A luminosity study of 2 quartz spectrographs was made by comparing optical and geometrical data. The French instrument was found to be distinctly inferior to the German one. A discussion of the effect of luminosity difference of spectrographs upon analytical curves leads to the conclusion that curves obtained with one spectrograph cannot be utilized for the interpretation of spectrograms obtained with another app.

2531. LOEUILLE, E.

Filters, Step Slits, Optical Wedges, and Sectors Used for Quantitative Spectrographic Analysis.

Congr. groupe, avance. method. anal. spectrograph. produits mét., 6, 37-46 (1946).

C. A., 41, 4969h (1947).

A description and math. analysis of app. used in front of a spectrograph slit to modify the intensity of the light along the length of a spectral line.

2532. LOEUILLE, E.

Multiple Electrode Holder of the Central Lab. of Armament.

Congr. groupe, avance. method. anal. spectrograph. produits mét., 6, 55-6 (1946).

C. A., 41, 4970c (1947).

Details of operation and a description are given of this app. for use in spectrography.

2533. LOMONOSOVA, L. S.

The Sorting of Several Alloys of Nickel with the Steeloscope.

Zavodskaya Lab., 12, 635-7 (1946).

C. A., 41, 1951d (1947).

Monel, Constantan, Manganin, 2 kinds of Nichrome, Konel, Invar, Platinite, Frigidal, Covar, Fernico, and Mn with 1-4% Ni can be distinguished from one another with the steeloscope. The lines 4651 (Cu), 4649 (Ni), 4655 (Fe), 4868 (Co), 4922 (Cr), 6022 (Mn), 6024 (Fe), 4649 (Ni), 4652 (Cu) Å were used mostly. From the relative intensities of these lines, the identification is made possible, as is explained.

2534. LOPEZ DE AZCONA, J. M. AND CAMUÑAS PUIG, A.

Spectrochemical Evaluation of Copper in Light Alloys Containing More Than 5% of This Metal.

Anales. fis. y quim. (Madrid), 42, 609-16 (1946).

C. A., 41, 4735h (1947).

The app. used was that of Feussner (*C. A.*, 29, 3555^g). The Cu content varied from 5 to 14%. Comparison of the blackening of lines Al 3064 and Cu 2294 gave results within 5% of the truth. 5 references.

2535. LOPEZ DE AZCONA, J. M., SANTOS RUIZ, A., AND DEÁN GUELBEZU, M.

Trace Elements in Spanish Foods of Vegetable Origin. IV. Condiments and Stimulants.

Anales fis. y quim. (Madrid), 42, 825-42 (1946).

C. A., 41, 5649c (1947).

Tea, cinnamon, caper, camomile, mustard, radish, cacao, various mints, laurel, garlic, clove, licorice, black and red peppers, coffee, caraway, anise, celery, coriander, cumin, fennel, parsley, and verbena were examined. Al, Ba, Cu, Fe, Li, Mn, Si, and Ti were found in all samples, Mo and Pb in 41%, Co in 25%, V in 12%, Ag in 8%. Mo and Co were found mostly in seeds. Pb and Sn are probably accidental inclusions. 5 references.

2536. LUNDEGÅRDH, H.

Quantitative Spectral Analysis as Applied to the Determination of Phosphorus in Plants.

Kgl. Lantbruks-Högskol. Ann., 13, 274-89 (1946) (in English).

C. A., 41, 662i (1947).

To det. P spectrographically it was found necessary to prep. a series of plots for the amts. and concns. of other atoms, such as Zn, Fe, and Ca, that interfere by either intensifying or weakening the P lines. The Pfeilsticker method (*C. A.*, 35, 6211ⁱ) was used. The sample was heated by an arc of 110 v. and 4 amp. started by a 70,000-v. spark. The gap was held at 3.5 mm. between Al electrodes 6.5 mm. in diam. bored out with holes 5.5

mm. in diam. The line P 2553.3 Å and the large quartz Littrow spectrograph of Hilger were used. For amts. more than 7 millimols. per 100 g. the standard deviation was 7%. The method would seem to be most useful in a series of samples in which P alone varied.

2537. LUNDEGÅRDH, P. H.

Rock Composition and Development in Central Roslagen, Sweden.

Arkiv. Kemi, Mineral. Geol., A23, No. 9, 160 pp. (1946) (in English).

C. A., 41, 2355d (1947).

Spectrographic analysis for trace elements is first discussed with emphasis on errors and accuracy. The mineralogy and petrology of the area, with chem. and spectrographic analyses of leptites, lepite gneisses, amphibolites, gabbros, diorites, hornblendites, garnet, granite, gneisses, amphibole, allivalite, eucrites, peridotites, lamprophyres, and veined gneiss, are given. The accessory minerals microcline, iron oxides, epidote, allanite, apatite, sphene, zircon, and calcite are considered. The trace elements studied are Li, B, V, Cr, Co, Ni, Cu, Zn, Ga, Sr, Mo, In, Sn, and Pb; their concn. trends in the various rock types are shown graphically. In the allanite, Pr is highly favored at the expense of Ce. The trace elements B, V, Cr, Co, Ni, Cu, Zn, and In are generally completely absent from the quartz and feldspars except when in areas of metasomatism. The possible modes of entry of the various trace elements into the various minerals during the normal differentiation of the magma are shown in tables; the regional distribution of the trace elements is considered.

2538. LUTSENKO, A. V. AND SOROKINA, N. N.

Spectroanalytical Determination of Boron in Steel.

Zavodskaya Lab., 12, 574-6 (1946).

C. A., 41, 1947e (1947).

B in concns. of 0.001-0.005% is detd. in an activated a.-c. arc with the upper electrode of Al or C. The pair of lines B I 2496.78 and Fe 2510.8 Å were chosen for the analysis. Four samples contg., resp., 0.001, 0.002, 0.003, and 0.005% of B were used for the construction of calibration curves. The intensity of the line B 2496.78 Å for B concns. of 0.001% was less than the intensity of Fe 2497.03 Å; for B concns. of 0.002% the intensities were approx. equal; for B concns. of 0.003% the intensity of B 2496.78 Å was greater. In all except one of thirty samples B was distributed uniformly in the steel. The microstructure of the alloy had no effect on the detn., because comparatively large sample surfaces were used (7-8 sq. mm.). Two references.

2539. MACEDO, J. W.

A Versatile Arc-Spark Stand (for Non-destructive Testing).

Ind. Eng. Chem., Anal. Ed., **18**, 76-7 (1946).
C. A., **40**, 1066^a (1946).

The stand consists of a steel plate, capable of vertical and transverse motion with respect to the optic axis and massive enough to hold samples weighing 50 kg.

2540. MANDEL'SHTAM, S. L.

Introduction to Spectral Analysis.

Moscow: Gosudarst Izdatel. Tekh. Teoret. Lit., 1946.

C. A., **42**, 6276b (1948).

Reviewed in *Zavodskaya Lab.*, **13**, 251 (1947).

2541. MARKS, G. W. AND HALL, H. T.

Method for the Spectrochemical Determination of Germanium, Tin, and Lead in Ore Samples.

U. S. Bur. Mines, Repts. Invest., **3965**, 38 pp. (1946).

C. A., **41**, 4401d (1947).

After further research and development, the total-energy method of spectrochem. analysis will be suitable for general analysis of ore samples for Ge, Sn, and Pb. Results are reported of the effects of various extraneous materials, particularly Fe_2O_3 , CaO , MgO , Al_2O_3 , and SiO_2 , which enter into the formation of complex silicates, upon the intensities of the Sn line $\lambda 2840.0 \text{ \AA}$, of the Pb line $\lambda 2833.1 \text{ \AA}$ and of the Ge line $\lambda 3039.1 \text{ \AA}$. Enstatite, forsterite, and fayalite have the same effects, within the limits of exptl. error, upon the intensities of the Sn line as do the corresponding mixts. of the oxides in stoichiometric proportions. The intensities of Sn $\lambda 2840.0 \text{ \AA}$ and Pb $\lambda 2833.1 \text{ \AA}$ are highest when a matrix of Al_2O_3 or CaCO_3 is employed. The intensities are progressively decreased by MgO , Fe_2O_3 , SiO_2 , and graphite, resp.

2542. MCBURNEY, T. C.

The Spectrograph. Its Use in the Analysis of Metals and Ores.

Western Metals, **4**, No. 5, 32-5 (1946).

C. A., **40**, 4262^a (1946).

Description of a grating spectrograph, equipped with both arc and spark, and directions for its use. M. states that the high potential spark is best adapted to the quant. analysis of metals and alloys, such as Al, Zn, and steel, where the sample is of the proper size and shape to be machined or ground to a smooth, even surface on one side. The most desirable form is a 2-in. disk about 1 in. thick. It forms one electrode with C for the other. For qual. analysis, where great sensitivity is desired, the arc is best. Methods of sampling are discussed.

2543. MCCLELLAND, J. A. C.

Applications of the Intermittent Alternating Current Arc Technique of Spectrographic Analysis.

Analyst, **71**, 129-39 (1946).

C. A., **40**, 3359^a (1946).

Two techniques are described and applied to materials in which the elements were not present in the metallic state. The elements Mn, Pb, Sn, Cr, Al, Zn, Ni, Sr, Mg, V, Cd, Co, and Mo were detd.

2544. MEGGERS, W. F.

Spectroscopy, Past, Present, and Future.

J. Optical Soc. Am., **36**, 431-48 (1946).

C. A., **40**, 6970^a (1946).

Progress in the interpretation of atomic spectra since 1913 is reviewed and the present state of structural analysis of 450 atomic spectra of 82 elements is appraised as represented by 256 spectroscopic publications. The results of investigations since 1927 of the hyperfine structure of spectral lines are compiled in a table showing mechanical moments for 90 atomic nuclei, magnetic moments for 70, and quadrupole moments for 20. These results are assembled from 123 literature references. Advances in spectrochem. analysis since 1922 are briefly outlined. The present gaps in spectroscopic knowledge, and the desirable and foreseeable extensions or improvements in data and applications, suggest the future trend of spectroscopy.

2545. MEISEKOTHE, R. J.

Industrial Spectroscopy.

Wisconsin Engr., **51**, No. 1, 8-9 (1946).

C. A., **41**, 7296a (1947).

A discussion.

2546. MINTS, I. M.

Application of the Steeloscope for Sorting Permalloy.

Zavodskaya Lab., **12**, 884 (1946).

C. A., **41**, 3712g (1947).

Permalloys contg. 45-78% Ni cannot be graded satisfactorily with the steeloscope and an a.c. of 7-8 amp. because the intensity of the Ni lines does not change appreciably when the content varies from 45 to 78% Ni. The proposed method is based on the Fe content. Cu is used for the 2nd electrode. Suitable spectral lines of both Ni and Fe are given which can serve for all alloys.

2547. MITCHELL, R. L.

Applications of Spectrographic Analysis to Soil Investigations.

Analyst, **71**, 361-8 (1946).

C. A., **40**, 6191^a (1946).

Trace elements in soil (i. e., Rb, Li, Ba, Cr, Sr, Sc, Mn, Co, Ni, Zr, Zn, La, Y, Ag, Cu, V, Mo, Be, Ga, Sn, Pb, Tl, and Ge) can be detd.

best by means of the spectroscope, although in many cases chem. concn. methods are involved. At the Macaulay Inst. for Soil Research, detns. within about 10% of the truth, rather than the mere detection of the elements, is desired. In some cases only 0.2 ppm. of an element may be present, but even this low content is of importance as the collected data show.

2548. MITCHELL, R. L., SCOTT, R. O., AND FARMER, V. C.

Background Correction in Spectrographic Analysis.

Nature, 157, 193-4 (1946).—*Math. C. A.*, 40, 3359^a (1946).

In spectrographic analysis, values are frequently obtained for the logs of the intensities of spectral lines which are superimposed on backgrounds which cannot be disregarded. The calcn. of the intensity due to the line alone is considerably simplified by the use of a table giving values of $(\delta - \gamma)$ for values of δ , published in the Macaulay Inst. Annual Report for 1942-43.

2549. MONTEUX, Y.

Spectrographic Determination of Impurities in Metallic Aluminum.

Anais assoc. quim. Brasil, 5, No. 3, 45-8 (1946).

C. A., 41, 4059d (1947).

The procedure used is the high-tension spark method. For homologous pairs the line Al 3054.7 is used with Mg 2851.7 and Si 2881.6 for the detn. of these elements. For Fe, the pair Al 2367.1 and Fe 2395.6 is used. The spectrographic results agreed well with chem. analysis (cf. *C. A.*, 39, 1817^a).

2550. MORITZ, H.

Die Chemische Analyse. Vol. XLIII, Spectrochemische Betriebsanalyse.

Stuttgart, F. Enke Verlag (1946), 170 pp.

Reviewed in *Spectrochim. Acta*, 3, 125-6 (1947). A book covering the general basis for spectrochemical analysis and extensive descriptions of qualitative and quantitative techniques.

2551. MÜLLER, R. H.

Current Developments in Instrumentation in Analysis: Analytical Spectroscopy.

Ind. Eng. Chem., Anal. Ed., 18, 25 (1946).

A discussion of applications of photomultiplier tubes for direct measurement of spectra. Suggests the possibilities of employing the iconoscope and orthicon and the study of microsecond phenomena.

2552. MYERS, A. T.

Solution-intake Unit for Improved Operation of the Flame Photometer.

Ind. Eng. Chem., Anal. Ed., 185, 585 (1946).
C. A., 40, 5963^a (1946).

The use of a 3-way or 4-way stopcock makes it necessary to change only the sample soln. when readings are made with a flame photometer by means of a reference standard. Complete details of the setup are shown.

2553. MYERS, A. T. AND BRUNSTETTER, B. C.

Spectrographic Determination of Mineral Composition of the Tung Leaf as Influenced by the Position on the Plant.

Proc. Am. Soc. Hort. Sci., 47, 169-74 (1946).

C. A., 42, 3464i (1948).

Leaves of a 6 months-old seedling tree from a nutrition expt. were analyzed for Al, B, Ca, Cu, Fe, K, Mg, Mn, and P. Concn. (dry wt. basis) of Ca ranged from 0.6% in the youngest leaf to 4.9% in the next to the oldest. K (0.9 to 2.8%) and Mg (0.16 to 0.5%) also increased with age of the leaves while P showed a reverse trend, with a value of about 0.5% in the top leaves and a decrease to about 0.2% in the basal leaves. An increase with age of the leaves, expressed as γ per g., was also found for Al (50 to 900), Fe (70 to 375), Mn (45 to 300), and B (15 to 125). Cu did not show a definite trend with leaf position. These results indicate that the best samples for comparison of effects of nutritional treatments on tung leaf compn. are the fully expanded leaves from the middle nodes of the shoot.

2554. ODA, N.

Quantitative Spectral Analysis and Its Application to the Refining of Light Metals, Especially of Aluminum. XVII. Effect of the Difference in the Various Properties of Samples.

J. Electrochem. Soc. Japan, 14, 150-5 (1946).

C. A., 44, 5259f (1950).

In spectroscopic detn. of Si in Al, the results are affected by the previous treatment of the sample. This is due to the difference of the elec. discharge at the surface of the sample. If a suitable capacity and inductance is used in the discharge circuit and the comparison is made of the intensities of the pair of lines, 3051 Å of Al and 2882 Å of Si, the effect of the difference in previous treatments of the sample becomes negligible.

2555. OERTEL, A. C. AND STACE, H. C. T.

Errors in Spectrochemical (Flame) Analysis.

J. Soc. Chem. Ind., 65, 350-4 (1946).

C. A., 41, 1788a (1947).

A Hilger Automatic Large Quartz Spectrograph and an air-acetylene flame was used

for detn. of the exchangeable cations in soil, primarily the Ca, Mg, K, and Na ions. An av. standard error of less than 4% was obtained.

2556. ORSAG, J.

Analysis of Traces of Sodium in Aluminum and Certain Light Alloys Using a Spectrograph for the Visible Range.

Congr. groupe. avance. method. anal. spectrograph. produits met., 6, 21-3 (1946).

C. A., 41, 5412g (1947).

A spectrograph having a dispersion of 120 mm. for the range 4000-8000 Å is used to det. the intensities of various metals in Al and certain light alloys. The particular case studied was that of Na in Al contg. about 13% Si. A set of standard samples was used which contained 0, 0.02, 0.005, and 0.0005% Na. The yellow doublet of Na was used as one of the analysis pair of lines, while a darkening extending from 5800 Å to the doublet was used as the other couple. In this region the sensitivity of the photographic emulsion changes rapidly. It was found that after the addn. of about 0.6% Na to the molten alloy, the Na varied as follows, 0.015% one min. after addn., 0.010% after 3 min., 0.007% after 10 min. and 0.003% after 20 min. Na is eliminated very rapidly from the molten alloy and it was found that the optimum concn. is about 0.007%. The disappearance of Na is one of the essential conditions for the improvement in mech. properties and corrosion resistance of Al as it comes from the electrolytic tanks.

2557. OWEN, L. E.

High-Speed Spectrography.

Iron Age, 158, No. 6, 50-3; No. 7, 61-4 (1946).

C. A., 40, 6361^a (1946).

Modifications made to commercial spectrographic equipment to adapt it for high-speed routine control analyses are described.

2558. PERRY, E. S. AND COOKE, S. R. B.

Spectrographic Prospecting for Beryllium in Pegmatites of Western Montana.

Am. Mineral., 31, 499-502 (1946).

C. A., 40, 7095^a (1946).

Spectrographic tests of some 50 samples gave neg. results for Be, excepting for 3 samples that contained traces.

2559. PIERUCCINI, R.

Spectrographic Determination of Copper in Some Serpentes of Northern Tuscany and in the Ophiolitic Rocks of Poggio Caprona, Leghorn.

Atti soc. toscana sci. nat., 53, 142-52 (1946).

C. A., 43, 6954b (1949).

The detn. of 24 rocks gave values between 0.000024 and 0.00716% CuO; only 1 sample

gave 0.0141%. This is thought to be too little to explain the native Cu which is found near the ophiolitic formations.

2560. PIERUCCINI, R.

Spectrographic Determination of Nickel and Chromium in Rocks of the Ophiolitic Formation.

Periodo Min., 15, 147-205 (1946).

Spectrochim. Acta, 3, 656-7 (1949).

For geochemical purposes the concns. of Ni (0.01-0.41% NiO) and Cr (0.001-1.7% Cr₂O₃) in 22 different rocks of the ophiolitic formation were spectrographically detd. by the Göttingen carbon arc method. The reference element is Fe which is present in varying concns. (3-14% Fe₂O₃). In the photometric evaluation of the spectrograms, galvanometer deflections for analysis lines of Cr (4289.73 and 4254.34 Å) and Ni (3461.66 and 3414.74 Å) were compared with those of Fe lines (4294.1 4282.4, 4247.4, 4235.9, 4233.6 for Cr, and 3459.9, 3417.8, 3415.5, 3413.1, 3411.3 and 3401.5 for Ni). For calibrating the procedure a synthetic mixture of 10% MgO, 15% Al₂O₃, 10% Fe₂O₃, and 65% SiO₂ was used, to which suitable concns. of Cr and Ni in the form of nitrate solns. were added.

2561. PIERUCCINI, R.

Spectrographic Determination of Nickel and Chromium in Some Sedimentary Rocks of the Tuscan and Milanese Appenines.

Rend. soc. mineral. ital., 3, 207-20 (1946).

C. A., 42, 3293a (1948).

Seventeen samples, spectrographically analyzed, gave 0.00297-0.0160% NiO and 0.0111-0.0702% Cr₂O₃. This diminution of concn. in comparison with the av. of the lithosphere compn. (and therefore with the compn. of the magmatic rocks) is ascribed to a mere diln. caused by sediments which did not contain large quantities of Ni and Cr.

2562. RAMAMURTHY B. AND DESAI, S. V.

Preliminary Studies of the Nutritional Diseases of Plants and Their Spectroscopic Diagnosis.

Indian J. Agr. Sci. 16, 103-11 (1946).

C. A., 42, 5085f (1948).

The arc spectra of soils and plant samples indicated that mineral deficiencies in plants were often caused by an upset of nutrient balance rather than a deficiency of an element in the soil. Thus tobacco leaves showed a B deficiency although the soil contained sufficient B. The spectra of the ash of the deficient leaf indicated less Ca and B and more K, Mg, Fe, Mn, and P than normal. The deficiency of B resulted, from an unfavorable Ca/K ratio. In other soils, a Mn excess caused an Fe deficiency in the plants. An improve-

ment in the leaf followed an injection of Fesoln. but an aggravation of symptoms after a Mn soln. The pH of the soils suggested 7.5 to 7.8 as the limits for this deficiency. Chlorotic wheat leaves contained unusually large amounts of ash and K but low Mn, B, and Ca. The Mn deficiency here was due to the high pH and excessive K of the soil. Chlorotic barley leaves showed a deficiency of Mn, B, and Ca caused by an excess of K and Fe in the soil. The "yellowing disease" of oranges indicated symptomatically a Zn deficiency but the ash spectra showed excess Fe and deficient Mg resulting from high Fe in the soil. The "band" disease of betel nuts was similarly shown to result from an excess of Mn and deficiency of Zn in the soil. The spectrochem. analysis thus gave an insight into both the deficiency and the causative excess.

2563. RAMAMURTHY, B. AND VISWANATH, B.

IX. Minor or Trace Element Status of Indian Soils — Spectroscopic Estimation of Boron Contents.

Indian J. Agr. Sci., 16, 420-6 (1946).

C. A., 43, 9311h (1949).

The soils were examd. spectroscopically by the methods of Gerlach and Schweitzer (Foundations and Methods of Chem. Analysis by Emission Spectrum, 123 pp. (*C. A.*, 26, 1942)) and also Mitchel (*C. A.*, 40, 6191¹). The accuracy of the results was ensured by printing 1 or 2 known standards on each plate and keeping the elec. and mech. conditions as nearly const. as possible. The surface foot-layer of virgin and cultivated soils from various parts of India were examd. The results show that the B contents are comparable with those of the U. S. and show as much variation. The av. amt. increases with the color or nature of the soil in the sequence—red-black, brown, gray and pink, and calcareous. The soil B shows a definite tendency to decrease with the geol. age of the rocks from which the soil is derived. The B content of the cultivated soils differs considerably from that of the corresponding virgin soils and this is shown to be dependent, among other things, on the nature of the irrigation water and the manural treatment employed.

2564. RANKAMA, K. AND JOENSUU, O.

A Simplified Method of Quantitative Spectrochemical Analysis in the Carbon Arc Cathode Layer, Based on the Use of the Logarithmic Wedge Sector.

Bull. comm. géol. Finlande, No. 138; *Compt. rend. soc. géol. Finlande*, No. 19, 8-20 (1946) (in English).

C. A., 40, 7043⁴ (1946).

Concn. calibration curves for the detn of Cb were run for TiO₂ base and for SiO₂

base to which 50% Na₂CO₃ was added. Even burning was obtained by the addn. of 4 parts C + 1 part NaCl. With the TiO₂ base, the lower limit was 0.03% Cb₂O₃, and the method was usable to 3% Cb₂O₃. The mean error, calcd. from replicates, was 14.5% of the abs. amt. With SiO₂-Na₂CO₃ base, the lower limit was 0.003% Cb₂O₃. The method is of sufficient accuracy for geochem. work and has been used for the detn. of Cr in granites. (0.0003-0.003% Cr₂O₃).

2565. RICARD, R.

Slitless Spectrograph.

Compt. rend., 222, 1091-2 (1946).

C. A., 40, 6997¹ (1946).

The following practical difficulties are encountered when a slit spectrograph is used. The luminous source and the auxiliary lens which form an image on the slit must be exactly aligned on the optical axis of the collimator; the illumination of the collimator lens varies rapidly when the source departs from this axis. The angular field of a slit spectrograph is so small that it is practically impossible to photograph the spectrum of a moving source or of one whose position is not predetd., e. g., lightning. Finally one observes the spectrum only of that part of the source that is imaged on the slit. These objections are removed by eliminating the slit without damaging the quality of the spectra observed. The brilliant virtual focus of a polished steel needle, 1 mm. diam., is used in place of the slit, and the source is placed in a direction which forms an angle between 60° and 120° with the collimator axis. This arrangement is advantageous for spectrochem. analysis because one thus observes the spectrum of the entire luminous source and small displacements of the spark produce only second-order variations in the illumination of the prism. As compared with a similar proposal to use the focus of a cylindrical lens of very short focus (*C. A.*, 40, 2742²) a reflecting cylinder of metal has the advantage of being achromatic.

2566. RIGHINI, G. AND VIVARELLI, S.

Spectrographic Determination of Iron in Glass.

Atti fondazione "Giorgio Ronchi," 1, 13-17 (1946).

C. A., 43, 3161g (1949).

Results are given.

2567. ROACH, W. A.

Flame Method of Spectrochemical Analysis.

J. Soc. Chem. Ind., 65, 33-9 (1946).

C. A., 40, 3693⁷ (1946).

A flame method for routine use is described and illustrated by drawings. It is useful for detecting and detg. Ca, Cu, Fe, K, Mn, Na, and Sr in plant materials. The material

is folded between filter paper, heated in NH_4Cl vapor and finally fed automatically into the flame of an oxyacetylene blowpipe which is in front of the spectrograph.

2568. ROZSA, J. T.

Spectrographic Technique on the Charging Floor.

Iron Age, 157, No. 13, 42-6 (1946).

C. A., 40, 3071^a (1946).

The app. described operates on both arc and spark by using a 2- to 3-kv.-amp. generator and a 5000-v. a.-c. arc. Graphite electrodes are used, gap 2 mm., pre-spark 15 sec., exposure 30 sec. for steel, 20 sec. for pig Fe, 40 sec. for arc. For C or alloy steel heats of the open-hearth furnaces, preliminary, final, and ladle analyses were made for Cr, Cu, Mn, Mo, Ni, Si, and Sn. For the alloy steel heats of the elec. furnaces, all of these elements are detd. after melt-down and during the refining and final alloying stages. Final Ni analyses on certain grades of steel and ladle analyses for elements other than residual are not detd. spectrographically. Every heat is tested for the secondary residuals—As, Sb, Cd, Zn, Ti, V, Co, Pb, and Te. Analyses for special elements such as Ti, V, Al, B, and Mg are made whenever required and every alloy steel is analyzed for residual Si just before the final Si addn. Twelve-min. slag analyses for CaO and SiO_2 are made for all open-hearth heats. In blast-furnace control, each cast is checked for Mn, Si, and the residuals (Cr, Ni, Ti, V, Cu, and Sn). Lines are read by use of a photoelectric densitometer. The spark is used for all amts. above 0.15% and the arc for all values below. Various means of increasing the degree of precision are described. With the app. described, analysis of 7 elements with a 2-man crew can be consistently reported out in less than 15 min., with the analysis of any one element reported in as low as 8 min.

2569. RUDNEVSKIĬ, N. K.

Analysis of Piston Alloys by the Spectral Method.

Zavodskaya Lab., 12, 189-93 (1946).

C. A., 40, 7068^a (1946).

For analysis of Al alloys contg. Zn up to 0.5, Mg up to 0.5, Mn up to 0.5, Fe up to 1.5, Si 4.5-6.0, Cu 6.25-7.75%, the spectra were photographed by a Zeiss quartz spectrograph, and the relative intensities of spectral lines were measured by photometric interpolation. The lines Fe 2766.9 and Fe 2767.5 Å overlapping the Cu 2766.38 Å line did not interfere with the detn. of Fe, owing to their low intensities. The lines Fe 2382.04 and Cu 2392.04 Å were used in most cases. In detns. of Mn (less than 0.5%) the line Mn 2593.7 Å became very intense. In such cases better results were obtained with Mn 2949.2 and Cu 2961.18 Å. The agreements of spectral and

chem. analysis data were sufficiently accurate. The probable exptl. errors in detns. of the various components detd. with an a.-c. arc were: Zn (range 0.2-1.0%) with Zn 3345.0, 3345.0 and Cu 3307.95 Å, $\pm 3.3\%$; Mg (range 0.15-0.5%) with Mg 2852.1 and Cu 2824.4 Å, $\pm 4.2\%$; Si (range 4.5-6.0%) with Si 2435.2 and Cu 2441.6 Å, $\pm 2.9\%$; Fe (range 0.8-1.5%) with Fe 2382.04 and Cu 2392.64 Å, $\pm 3.0\%$ (with Fe 2755.7 and Cu 2766.4 Å, $\pm 3.2\%$); Mn (range 0.15-0.5%) with Mn 2593.7 and Al 2652.48 Å, $\pm 6.0\%$; Cu (range 6-8%) with Cu 2441.6 and Ni 2437.9 Å, $\pm 4.1\%$. Thirteen references.

2570. RUDNEVSKIĬ, N. K.

The Effect of Burning in Spectroanalysis of Aluminum Alloys in the Alternating-Current Arc.

Zavodskaya Lab., 12, 633-5 (1946).

C. A., 41, 1951b (1947).

The Duralumin spectrum was photographed successively 8 times during the course of the elec. discharge (77 sec.), each exposure lasting for 7 sec. The spectra of the Al-Si alloys were photographed for 10 sec., the total time of the discharge 115 sec. Curves of difference in blackening vs. time (cf. Kaiser, *C. A.*, 33, 6751^a) were constructed for the following pairs of lines: Si 2514.3-Si 2516.1 Å; Mg 2779.85-Mn 2593.7 Å; Fe 2755.7-Al 2652.48 Å; Al 2652.48-Cu 2824.4 Å; Cu 2824.4-Cu 2824.4 Å. The changes in the difference of blackening with time were insignificant. For binary Al-Si alloys the 1st point on the curve of the alloys contg. 6.32% of Si had in all cases a smaller difference in blackening than did the subsequent points, and the 1st point on the curve for the alloys contg. 18% of Si had in all cases a greater difference in the blackening than did the subsequent points. Eight references.

2571. RUSANOV, A. K.

Fulgurator for Spectrochemical Analysis of Solutions.

U.S.S.R. Patent 66,276, May 31, 1946.

C. A., 41, 1897a (1947).

The fulgurator is equipped with an atomizer to atomize the sample, and a tube to remove from the app. suspended drops prior to starting the discharge. Both the atomizer and the tube are connected to a source of compressed air and operate alternately automatically.

2572. RUSSELL, R. G. AND COGGESHALL, N. D.

Spectroscopy in the Ultraviolet and Visible Bands.

Chem. Industries, 58, 586-9 (1946).

C. A., 40, 3682^a (1946).

Review covering industrial uses for qual. and quant. analysis in both emission and absorption spectra.

2573. SALMI, E. J. AND LAAKSONEN, E.
The Spectrochemistry of Arsenic.
Suomen Kemistilehti, 19B, 108-12 (1946)
(in German).
C. A., 41, 5394c (1947).
2574. SANTOS RUIZ, A., DEÁN GUELLENZU, M., AND LOPEZ DE AZCONA, J. M.
Trace Elements in Spanish Foods of Vegetable Origin. III. Fruits.
Anales fis. y quim. (Madrid), 42, 657-66 (1946).
C. A., 41, 5649a (1947).
- Ag was found only in the banana. In the 72 samples examd., Ba was found only in quantities near the limit of sensitivity of the spectrographic method. Co was found in seeds of avocado and in the fruit of the strawberry family. Cu was obtained in all ash analyzed, between 10^{-3} and 10^{-4} , one exception having 10^{-2} . Fe and Li were in all samples. Mn was in all samples, but in quantity less than Cu and Fe. Mo was found in all varieties of oranges, in the seeds of melon and avocado, but not in the fruit, and in the tomato; Ni in 72 samples of ash; Pb in 30% of the samples; Si in all samples; Sn in 2 canned samples; Ti in all samples, between 10^{-3} and 10^{-2} ; V only in black mulberry and banana.
2575. SAUNDERSON, J. L. AND HESS, T. M.
Commercial Use of Direct-Reading Spectrochemical Analysis of Magnesium Alloys.
Metal Progress, 49, 947-55 (1946).
C. A., 40, 3653⁹ (1946).
- The results of 1 year's com. use of the new automatic equipment permits quant. analysis for Al, Ca, Zn, Cu, Mn, Si, and Be in Mg alloys in 5 min. Equipment is described, illustrated, and compared with photographic equipment (cf. *C. A.*, 40, 1090⁹).
2576. SCANLON, W.
Quantitative Method for the Spectroscopic Analysis of Potassium-Sodium Solution.
Phys. Rev., 69, 52-3 (1946) (Abstract).
C. A., 41, 3707b (1947).
- The above is a title of a paper presented before the *Am. Phys. Soc.* and published in abstract form.
2577. SCHMIDT, R.
Spectrochemical Analysis of Alloys by Means of Emission Spectra.
Metallen, 1, 37-44 (1946).
- Quantitative spectrochemical analysis by means of direct reading and photographic instruments with relative merits of each procedure. Survey of problems awaiting solution.
2578. SCHMIDT, R.
The Purification of Carbon Rods for Spectrochemical Analysis. II. Carbon Rods for Spectrochemical Analysis of Solutions.
Rec. trav. chim., 65, 265-9 (1946) (in English).
C. A., 41, 3b (1947).
- The Scheibe-Rivas method (cf. *C. A.*, 30, 6302⁷) of spectrochem. analysis of solns. makes use of C rods which are impregnated with the soln. to be analyzed. The undesirable feature found in these Co rods prepd. as mentioned above was attributed to the presence of a central cavity in the C electrodes caused by the sublimation of C at the high axial temp. during purification. More direct proof of the above fact was obtained by studying the distribution of different solns. in the electrodes. A temp. of 3300°K. or about 3000°C. is the highest surface temp. which yields homogeneous C rods. Indirect heating is probably allowable up to temps. above 3300°K. The porosity can be increased either by a prolonged heating or locally by exposing the surface to an arc discharge. The standard heat-treatment adopted is the following: The carbon rods are cut 176 mm. long for free radiating surface. The heating is effected by 48-v. a.c. The input is adjusted to 26 kw. at the max.; it gradually diminishes to 17 kw. after 2 min. The current is then turned off. The inputs mentioned correspond to surface temps. of 3000° and 2700°C., resp. The C rods have an apparent porosity of 0.08-0.01 μ l./sec./sq. mm., which is virtually const. along their lengths. This does not provide homogeneity in a radial direction. X-ray investigation indicates that the starting material is nearly amorphous. The porous layer consists of very finely divided graphite crystals, the dimensions of which seem to decrease with prolonged heating (probably due to oxidation).
2579. SCHMIDT, R.
Use of the Rotating-Step Sector in Combination with Intermittent Light Sources in Spectrochemical Analysis. II.
Rec. trav. chim., 65, 825-30 (1946) (in English).
C. A., 41, 2654i (1947).
- It is shown that the method previously described (cf. *C. A.*, 38, 4211⁸) can yield the relative intensity itself if the sector speed exceeds a certain crit. value which depends on the photographic emulsion and the illumination. Several emulsions were examd. by using mostly Cu lines. No unique relation between emulsion speed and crit. sector speed was found. It is planned to continue the study in a manner which eliminates electrode effects.
2580. SCOTT, R. O.
Spectrographic Determination of Trace Elements in the Cathode Layer Arc by the Variable Internal Standard Method.

J. Soc. Chem. Ind., 65, 291-7 (1946).

C. A., 41, 7296b (1947).

The method of Davidson and Mitchell (*C. A.*, 35, 556⁴) which utilizes the Fe content of soil as an internal standard for detg. trace elements in soils is described. Reëxamm. of the method of D. and M. by Scott is also described.

2581. SCRIBNER, B. F. AND MULLIN, H. R. Carrier-Distillation Method for Spectrographic Analysis and Its Application to the Analysis of Uranium-base Materials. *J. Research Natl. Bur. Standards*, 37, 379-89 (1946) (Research Paper 1753).

C. A., 41, 1571i (1947).

A method of fractional distn. in the d.c. arc is described which has been applied successfully to the spectroscopic detn. of 33 volatile impurities at concns. as low as 1 ppm. in U-base materials. First, the sample is converted into a matrix of low volatility, then a small quantity of suitable carrier material is added, and finally the mixt. is subjected to partial distn. in a d.-c. arc. In an analysis the U was converted into U_3O_8 and 2 parts of Ga_2O_3 was added to 98 parts of U_3O_8 . Successful detns. of Ag, Al, As, Au, B, Ba, Be, Bi, Cd, Co, Cr, Cs, Cu, Fe, Ge, Hg, In, K, Li, Mg, Mn, Mo, Na, Ni, P, Pb, Rb, Sb, Si, Sn, Ti, V, and Zn were made. Repeated photometric detns. of B, Cd, Si, Fe, Mg, and Mn agreed within 10%. The carrier serves to sweep out the min. quantity of impurity vapors and to stabilize the arc. This results in high sensitivity and accuracy for impurities present in quantities corresponding to a few ten-thousandths of 1%.

2582. SEMENOVA, O. P.

Mechanism of Arc Discharge.

Compt. rend. acad. sci. U.R.S.S., 51, 683-6 (1946).

C. A., 41, 1147i (1947).

See *C. A.*, 40, 5632⁴.

2583. SLOSS, L. L. AND COOKE, S. R. B.

Spectrochemical Sample Logging of Limestones.

Bull. Am. Assoc. Petrol. Geol., 30, 1888-98 (1946).

C. A., 41, 928i (1947).

Spectrographic analysis was used for differentiation and correlation of thick and unbroken sequences of carbonate rocks. The contents of Mg, Fe, Al, and Sr proved most useful.

2584. SMITH, D. M.

Spectrographic Analysis of Rare- and High-purity Materials.

Analyst, 71, 368-76 (1946).

C. A., 40, 6015⁴ (1946).

The use of the spectroscope for testing materials of high purity is outlined and various difficulties mentioned, such as the masking of lines and the presence of faint lines of doubtful origin. Various methods of arc excitation are discussed.

2585. SMITH, R. W. AND HOAGBIN, J. E.

Quantitative Spectrographic Analysis of Ceramic Materials.

J. Am. Ceram. Soc., 29, 222-8 (1946).

C. A., 40, 6231⁴ (1946).

A method, rapid enough to permit its use in routine control of mixing, grinding, and other manufg. processes, has been developed. The supporting electrodes are $\frac{1}{4}$ -in. diam. round carbons, in the ends of which recesses $\frac{1}{8}$ in. deep and $\frac{1}{8}$ in. in diam. have been machined. The counter electrodes are also $\frac{1}{4}$ in. in diam. carbons scored at 1-in. intervals so that 1-in. pieces can be broken off before each test. The internal standard mixt. used for the simultaneous detn. of Na_2O and SiO_2 is: de-ashed natural graphite 50, Cr_2O_3 5, calcined Li_4PO_4 0.15 g.; for the detn. of Na_2O only: de-ashed natural graphite 50, calcined Li_4PO_4 0.15 g.; and for the detn. of SiO_2 only: de-ashed natural graphite 50, MnO_2 12.5 g. These mixts. are mixed in a pint bottle rotated end-over-end for 1 hr. The sample to be analyzed is ground to pass 100-mesh. When possible 1 g. of sample is used, but 50- or even 40-mg. samples have been successfully analyzed. The sample is mixed with the appropriate internal standard mixt. in the proportion of 2:1 by wt. The combined materials are placed in a wide-mouth 1-oz. square glass bottle with screw cap which is loaded with 6 steel balls $\frac{1}{4}$ in. in diam. and shaken vigorously by hand for 1 min. The mixt. of sample and internal standard mixt. is then placed in the recess of the supporting electrode and struck off level with the edge of the spatula; packing is carefully avoided. Two carbons are loaded for duplicate exposures of each sample. The sample carrier is made the lower pos. electrode of a 10-amp. d.-c. arc. Calibration is obtained by means of a log sector rotating in front of the spectrograph slit and illuminated by an arc between Fe electrodes. The analytical line pairs (Na, Si, Li, Cr, Mn) are read on a densitometer. Estn. of K, Ga, Pb, Sn, B, Fe is made by visual comparisons with standard plates. Tests showed that spectroscopic analyses agreed with wet chem. analyses within limits no greater than would be expected from the combined errors of the 2 methods; that reproducibility was within an av. deviation of about 4%; that about 50 min. is required for a first sample plus about 10 min. for each addnl. sample. That the mode of combination of Na_2O and K_2O has a pronounced influ-

ence on their spectral excitation must be recognized in analyzing unknown or admittedly different materials.

2586. STEELE, S. D.

Applications of Emission Spectrography in Ferrous Analysis.

J. West Scot. Iron Steel Inst., 54, 6-44 (1946-47).

C. A., 42, 7651b (1948).

A review with 15 references and discussion. The possibility of using air optical diffraction grating made by causing supersonic waves to traverse a liquid is mentioned in the discussion. Such a grating would permit a higher degree of dispersion to be obtained.

2587. STERN, J.

Interference in Thin Parallel-Surfaced Transparent Plates as a Source of Error in Spectroquantitative Analysis.

J. Optical Soc. Am., 36, 654-8 (1946).

C. A., 41, 318g (1947).

Many com. spectrographs use flat quartz windows to protect the delicate slit-mechanism from dust and mech. injury. Interference effects of such thin plates can cause errors in spectrochem. analysis by falsifying plate calibrations and measurement of wavelengths and intensity ratios of spectral lines. Such errors can be avoided by using a lens instead of a flat plate as a slit cover.

2588. SUKHENKO, K. A. AND BOGDANOVA, V. V.

The Use of a Constant Copper Electrode in Spectral Analysis of Low-Alloy Steels.

Zavodskaya Lab., 12, 253-4 (1946).

C. A., 40, 7044^a (1946).

Spectrally pure Cu was used as the electrode. A Feussner source was used to produce a spectrum. Curves obtained indicate that 40 sec. is sufficient to obtain stable results. The accuracy of the analysis with Cu electrodes was 4-7%. The lines Ti 3349.0 and Cu 3274.0 Å were used to det. Ti and the lines Cb 3094.19 and Fe 3083.7 Å to det. Cb. One reference.

2589. SVENTITSKIĬ, N. S., FEDOROV, M. F., AND KHUDOMINSKAYA, L. S.

Determination of Nickel in Steels with the Steeloscope.

Zavodskaya Lab., 12, 569-73 (1946).

C. A., 41, 1948i (1947).

A no. of lines were studied. Best results were obtained with Ni 5035.4, 5080 and 4717.4 Å in conjunction with the lines Fe 5036.5, Fe 5029.6, 5039.3, 5041.1, and 5041.8 Å.

2590. TAGANOV, K. I.

Analysis of Lead and Its Oxides by the Spectral Method.

Zavodskaya Lab., 12, 449-54 (1946).

C. A., 41, 1172a (1947).

A rapid method is described for the analysis of Pb and its oxides for Mn, Zn, Sn, Cd, Sb, Ni, Cu, Ag, Bi, and As. The spectral lines used were 3067.7 Å for Bi; 2288.0 Å for Cd or 2349.8 Å if As was present; 3247.5 and 3274 Å for Cu; 2349.8 for As; 2605.7 and 2798.3 for Mn; 3414.8 for Ni; 2840.0 and 2863.3 for Sn; 2311.5 for Sb; 3280.7 and 3383.9 for Ag; 2138.5 and 3345.0 for Zn. Most of the Ag began to evap. only after 2-3 min. In Pb(NO₃)₂ and PbSO₄, the Ag lines appeared during the initial 30 sec. when these salts began to decomp. under the influence of the high temp. of the arc. During the analysis this effect was almost absent and the Ag lines (at concns. studied, 0.001%) began to be observed only after 2-3 min. A comparison of control analyses with results of chem. and polarographic analyses indicated that the method can be used for rapid semiquant. analysis of Pb and its oxides. 6 references.

2591. TARDY, H.

Chat on Spectrographs.

Congr. groupe. avance. method. anal. spectrograph. produits mèl., 5, 37-45 (1946).

C. A., 40, 6996^a (1946).

An elementary discussion of the parts, properties, and performance of prism spectrographs of interest to the spectrochem. analyst.

2592. THOROLD, C. A.

Spectrographic Analysis of Coffee Material.

Ann. Applied Biol., 33, 177-8 (1946).

C. A., 40, 7314^a (1946).

In connection with studies of Elgon dieback, a physiol. disease of coffee in Kenya Colony, E. Africa, an investigation was made to det. whether the affliction was a deficiency disease. Samples of stems and beans of Kenya coffee, from *Coffea arabica* trees severely affected with the disease, and from trees known to be resistant, were analyzed spectrographically. The stems were oven-dried, the beans air-dried, before analysis. The following elements in equiv. amts. were present: Al, Ba, Ca, Cu, K, Li, Mn, Na, and Sr. Elements present in greater amts. in resistant than in susceptible wood were: B, Fe, P, Pb, Rb, Si, and Zn. Elements present in resistant wood but absent from susceptible wood: Ag, Cr, Ni and Sn. The 2 bean samples showed no large differences between the major components which were present in the following percentage amts.: K 1.1, Ca 0.2, Mg 0.2, Na 0.02, Rb 0.02, SiO₂ 0.1, phosphate 0.4-0.5%. Minor components, in ppm. of good-quality beans and poor-quality beans, follow: Al 0, 30; Ba 5, 24; B 4, 5; Cr 0.3, 0.2; Cu 20, 32; Fe 26, 60; Pb 0.6, 0.2; Mn 20, 27; Sr 15, 20; Ag 0.02, 0. The quant. analysis of stem ma-

terial shows a large amt. of the majority of the elements in the more robust, resistant type of plant material; but, except for Zn, there were no very large differences. Zn was not found in the beans. Application of Zn in soln. to coffee trees by the Roach injection method (C. A., 29, 2647⁸) did not increase the vigor or disease resistance of the injected trees. Conclusion: Elgon dieback cannot be accounted for by a deficiency of any of the major or minor elements as detd. spectrographically. Analysis of the beans shows excess of only unimportant elements (Al, Fe, Ba) in poor as compared with good quality coffee.

2593. TIGGELEN, A. VAN.

Spectrographic Determination of Deuterium.

Bull. soc. chim. Belges, 55, 133-59 (1946).
C. A., 41, 4401b (1947).

Mixts. of H and D with compns. varying from 15 to 85% can be analyzed spectrographically to within 2% of the minor constituent. The mixt. at a pressure of 1.5 mm. Hg is contained in a Geissler tube with external electrodes, where it is submitted to Tesla discharge. The compn. is detd. from relative intensities on a photographic plate by the stepped-sector method. The Geissler tubes must be previously outgassed at 350°. H₂S-D and NH₃-D mixts. are analyzed similarly. Exptl. intensity-concn. relations indicate a preferential excitation of H resulting from the difference in zero-point energy between H and D compds.

2594. TOMLINSON, W. H.

Rutile in Harford County, Maryland.

Am. Mineral., 31, 322-5 (1946).
C. A., 40, 4981⁶ (1946).

A chlorite rock near Clermont Mills contains rutile and apatite as accessory minerals. The rutile content may be as high as 16% in some pockets. It probably represents the alteration product of a pyroxenite rich in ilmenite. Spectrographic analyses are given of the rock and of selected rutile crystals.

2595. VIGNERON, G., PERLINGHI, O., AND VANDENBOSCH, V.

Quantitative Spectrochemical and Polarographic Analysis of Mineral Grains from Clay Deposits of the Bois-Planté à Mozet (Belgium).

Bull. classe sci., Acad. roy. Belg., 32, No. 10/11, 564-75 (1946).
C. A., 41, 6837d (1947).

These mineral grains are shown to contain appreciable amts. of Mn, Co, and Ni.

2596. WALSH, A.

General-purpose Source Unit for the Spectrographic Analysis of Metals and Alloys.

Bull. Brit. Non-Ferrous Metals Research Assoc., No. 201, 60-80 (1946).

C. A., 40, 3027¹ (1946).

A new unit has been constructed which provides a simple condensed spark, a low-voltage d.-c. arc, and a whole series of intermediate conditions. Details of the circuits are described. Detailed results are given for 11 analyses, each comprising from 15 to 50 spectra: 5 samples of duralumin, two of Mazak 3 (a Zn, Al, Mg alloy); two of binary Pb-Sn, binary Pb-Sb, and Pb alloy E (BS 801) for cable sheathing. The percentage standard deviations obtained for each metal are approx. half those quoted for other techniques. This unit can be arranged to give high sensitivity together with a higher accuracy than is possible with a d.-c. arc, or to give a high degree of reproducibility.

2597. WILSON, G. E.

A Micro-Filter Stick for Use in Spectrographic Analysis.

Analyst, 71, 375-9 (1946).
C. A., 40, 6015⁴ (1946).

The use of the spectrograph for detg. microchem. quantities of solids necessitates the transfer of the material to the cathode crater from one of many types of filters. To avoid mech. loss and to gain time, it is well to convert the cathode C itself into a filter stick. A simple method for doing this is described. The tool shown is hand-operated and easily controlled.

1947

2598. ABRAMSON, I. S. AND MANDEL'STAM, S. L.

Optical and Electric Research on Short Impulse Processes in the Activated Alternating-current Arc.

Bull. acad. sci. U.R.S.S. Sér. phys., 11, 223-7 (1947).
C. A., 42, 1799e (1948).

The authors examd, with a photomultiplier and an oscillograph the ripple appearing in

the light-intensity oscillogram in each cycle of a discharge. The following lines were studied: Hg 4358 Å (low-pressure Hg-A arc) Zn I 4811 Å (arc between Zn electrodes) Zn I 4811 Å, Zn II 4925 Å (spark), Al II 4663 Å, and Al III 4330 Å (spark). The oscillograms show that the temp. at the start of the discharge is higher than at the end. The oscillations seem to come from whirls of gas in the channel of the arc.

2599. ABRAMSON, I. S. AND SVENTITSKIĬ, N. S.

Investigation of the Activated Alternating-current Arc.

J. Tech. Phys. (U.S.S.R.), 17, 43-52 (1947) (in Russian).

C. A., 42, 3223e (1948).

Oscillograms were taken of the potential across and current through the gap of the Sventitskiĭ-activated a.-c. arc. In the arc-type operation (series inductance $L = 370 \mu H$, blocking capacitance $C = 0.25 \mu F$), the potential drop was approx. const. and equal to 40 v. The max. current was 10 amp. For spark-type operation the corresponding values were observed on a single spark which was used to trigger the sweep of an oscilloscope with a long-persistence screen. With $L = 70 \mu H$ and $C = 8 \mu F$, the potential drop was 20 v. and the max. current 75 amp. The spark discharge lasted about 80 microsec. The latter discharge was nonoscillatory, but oscillatory trains lasting 6 microsec. and having peak currents of 200 amp. were obtained by using $L = 10 \mu H$ and $C = 8 \mu F$. Current i in the spark path was measured by observing the width of a single spark of known amperage at a given time. Values of $0.2-2.0 \times 10^6$ amp./sq. cm. were obtained for spark operation, and $5.6-7.5 \times 10^8$ amp./sq. cm. for arc operation. Changes in L affect the intensity ratios of Cu spark lines to Cu arc lines much more strongly than do changes in C , but increases in C noticeably diminish the intensities of N II lines.

2600. ABREU PAIVA, J. DE.

Spectrographic Method for the Estimation of the Lead Content of Blood.

Rev. quim. e farm. (Rio de Janeiro), 12, No. 9, 13-30 (1947).

C. A., 42, 1328d (1948).

Digest 5 cc. of blood in a Kjeldahl flask with 30 cc. of a 2:1 mixt. of $HNO_3:HClO_4$ by carefully heating to dryness. Add a little twice-distd. water, 2 cc. of $Bi(NO_3)_3$ soln. (contg. 10 γ of Bi) and 3 drops of H_2SO_4 . Evap. almost to dryness, add 10 drops of H_2SO_4 and ash at 300° . Dissolve the residue in twice-distd. HCl. Ash again at 300° , then proceed with the spectrographic analyses which are described in great detail.

2601. AHRNS, L. H.

Analyses of the Minor Constituents in Pollucite.

Am. Mineral., 32, 44-51 (1947).

C. A., 41, 3402e (1947).

Samples of pollucite from Greenwood, Me., Tin Mt., S. Dak., and Varuträsk, Sweden, were found by spectrographic analysis to con-

tain resp., 0.0019, 0.0019, 0.008% Tl_2O ; 0.68, 0.25, 0.37% Rb_2O ; 0.16, 0.19, 2.5% K_2O ; 0.008, 0.006, 0.053% Li_2O ; and 0.0005, 0.0005, 0.001% Ca_2O_3 . Sr was found qualitatively in all 3 samples and the Sr/Rb ratios are roughly in agreement with those calcd. from the geol. ages of the samples on the assumption that the Sr was all formed by the radioactive disintegration of Rb^{87} (*C. A.*, 40, 3080*).

2602. AHRNS, L. H.

The Determination of Geological Age by Means of the Natural Radioactivity of Rubidium: a Report of Preliminary Investigations.

Trans. Geol. Soc. South Africa, 50, 23-54 (1947).

Spectrochim. Acta, 4, 185 (1950) (An abstract).

A spectrochemical method is described (pp. 29-42) for the determination of the Sr/Rb ratios of minerals. The mineral samples were first converted to fluorides by treatment with hydrofluoric acid and evaporation to dryness, in order to make the strontium and rubidium evaporate from the arc at the same time. The samples were then filled into borings 3.2 mm. deep and 2.8 mm. diameter in carbon anodes of 3.6 mm. outside diam., and arced with 6.5-amp., 250-v. direct current. Each exposure was made using a seven step sector with a times-two ratio in front of the slit of a Hilger large quartz spectrograph, and the intensities of the lines Sr 4077 and Rb 4204 found by a constant blackening background correction method, similar to that of Scott (*J. Soc. Chem. Ind.*, 63, 25 (1944)). Methods for correcting for the interferences of the Rb line 4201.9 from the Fe 4202.03, and of the Sr line 4077.71 from Ti 4078.47 are described.

2603. ALEKSEVA, V. G. AND MANDEL'SH-TAM, S. L.

The Excitation of Atoms of Metals in the Inner Cone of a Flame.

J. Exptl. Theoret. Phys. (U.S.S.R.), 17, 759-63 (1947) (in Russian).

C. A., 42, 1503d (1948).

From measurements of the relative intensities i of the 2840, 2850, 2863, 3009, 3175, and 3262 Å lines of Sn in the inner cone of an acetylene-air flame (sepd. from the outer cone by a quartz tube), and the probabilities p of transition and the energies ϵ of the upper levels, absence of a Boltzmann distribution of the excited states (in contrast to the outer cone) was concluded from the nonlinearity of $\log(i/p)$ as a function of ϵ . In contrast to the outer cone, where inversion of the Na 5890, Li 6707, K 4044, and Tl 5350 Å lines occurred at the same temp. (2530°), each line gave a different temp. in the inner cone (Na

1860°, Li 2270°, K 2110°, Tl 2520°), in disagreement with Kirchhoff's law. Consequently, excitation of metal atoms in the inner cone is not thermal; chemiluminescence phenomena evidently play a major role.

2604. ALEKSEBEVA, V. G. AND MANDEL'SH-TAM, S. L.

Factors Affecting the Intensity of Spectral Lines in Flames Used in Spectrochemical Analysis.

Zhur. Tekh. Fiz., 17, 765-80 (1947).

C. A., 46, 1911e (1952).

When Sn compds. are introduced into the air-C₂H₂ gas stream in powder form (mixed with graphite and an internal standard), the intensity of the Sn line depends on the volatility of the Sn compd., not on the dissocn. const. of any vapor-phase mol. When volatility differences are not a factor, as in the Lundegårdh technique, anions do not affect metallic line intensities. With this technique, the lines of Sn, Bi, Cd, and As are more intense in the inner cone than in the outer cone because MeO mols. are formed in the latter. Lines of Li, Na, and K are more intense in the outer cone because MeOH mols. are formed in the inner cone. Dissocn. consts. $k_p \times 10^8$ for the inner and outer cones, resp., are: SnS 2.2 and 8; SnCl₂ 5,600 and 22,400; NaCl 2.5 and 13; KCl 160 and 890; SnO 0.056 and 0.49; CdO 0.085 and 0.8; Na₂O 0.8 and 16; K₂O 350 and 800; CaO 0.43 and 4.5; MgO 3.3 and 45; NaOH 50 and 400; KOH 10 and 500.

2605. AMY, LUCIEN.

Scientific Methods of the Police.

Chim. anal., 29, 233-8 (1947).

C. A., 42, 477d (1948).

This is the first installment of a paper on the methods used by the French police in the detection of crime. The application of the spectrograph to the determination of trace elements is discussed and applications are given.

2606. ATTOE, O. J. AND TRUOG, E.

Rapid Photometric Determination of Exchangeable Potassium and Sodium.

Soil Sci. Soc. Am. Proc., 11, 221-6 (1947).

B. A., 22, 674, abstract no. 7284 (1948).

A procedure is proposed for the detn. of exchangeable K and Na in soils in which the soil extract is tested directly with the flame photometer for these elements. The av. error incurred in the detn. of additions of known amts. of K and Na to the extracts of 10 different soils was 2.2% for K and 2.1% for Na. In another test in which 8 soils were analyzed for exchangeable K by the flame photometer and by cobaltinitrite methods, there was an av. difference of 3.9% between the 2 methods in the amt. of exchangeable K

found. The advantages of this method are: much time is saved in making detns., the method is accurate, detn. of both K and Na may be made on the same extract, and chances for loss or contamination are minimized because of simplicity.

2607. AVERBUKH, M. M. AND ERINA, I. I.

The Determination of Manganese in Malleable and Gray Cast Iron with the Steeloscope.

Zavodskaya Lab., 13, 181-4 (1947).

C. A., 42, 2542f (1948).

Comparison of Mn lines in the 4760, 6020, and 4451 regions with neighboring Fe lines permits estimates of Mn concns. in the range 0.1-1.0%. An analysis takes 2 min.; agreement with chem. analysis is excellent.

2608. BABAEVA, A. V., BELOVA, V. I., AND BOROVNIK, S. A.

Spectroscopic Analysis of Small Quantities of Iridium and Rhodium in Platinum Preparations.

Izvest. Sektora Platiny i Drug. Blagorod. Metal. Inst. Obshchei i Neorg. Khim. Akada. Nauk S.S.S.R. (Ann. secteur platine, Inst. chim. gén.), No. 20, 168-71 (1947).

C. A., 44, 5262e (1950).

This method is particularly adapted for detg. Ir and Rh in intermediate products of Pt refining. Two procedures were worked out, one using an arc spectrum and the other a spark. The arc spectrum gave a probable error of 10-20% in detg. Ir and Rh. The lower limit for detg. these metals was 0.01%. The arc spectrum required too much of the precious metal and therefore the spark method proved preferable for routine analyses. For the spark spectrum purified C electrodes of 3 mm. diam. were used. The lower electrode had a 0.4-0.5 mm. deep cavity to receive the sample weighing 0.003 g. The spark gap was 3.5 mm., exposure 15-45 sec. For Ir concns. of 0.5-0.05% best results were obtained with the pair of lines Ir 3220.79 and Pt 3230.29 Å and for Ir concns. below 0.05% with Ir 3220.79 and Pt 3212.00 Å. For Rh the preferred lines were Rh 3396.82 and Pt 3427.92 Å. For Rh concns. below 0.005%, it was preferable to use the pair Rh 3434.9 and Pt 3427.92 Å. By this procedure the av. probable error in detg. Rh was ± 8.5 and in detg. Ir $\pm 7.8\%$.

2609. BABAEVA, A. V., BELOVA, V. I., AND NAZAROVA, L. A.

Spectroscopic Determination of Palladium in Platinum, Platinum in Palladium, and Rhodium in Iridium,

- Izvest. Sektora Platiny i Drug. Blagorod. Metal., Inst. Obshchei i Neorg. Khim., Akad. Nauk S.S.S.R. (Ann. secteur platine, Inst. chim. gén.), No. 20, 172-5 (1947).*
C. A., 44, 5263b (1950).
 The detns. were carried out in a condensed spark spectrum. For 5-0.7% Pd in Pt the preferred lines were Pd 3027.91, Pt 3017.88 Å, and for 0.7-0.001% Pd the lines were Pd 3404.59, Pt 3427.92 Å. For 5-0.2% Pt in Pd the preferred lines were Pt 2997.96, Pd 3002.66 Å, and below 0.2% Pt, Pt 2997.96, Pd 2999.56 Å. For 1.0-0.001% Rh in Ir the preferred lines were Rh 3396.82, Ir 3310.54 Å. Although the lines of this pair are quite apart, their intensity is comparable. If desired the pair Rh 3434.90, Ir 3437.05 Å can also be used.
2610. BARKOV, B. N. AND ROZHKOV, E. M.
 The Determination of Small Quantities of Manganese in Steels with the Aid of the Steeloscope.
Zavodskaya Lab., 13, 184-6 (1947).
C. A., 43, 3318a (1949).
 Two surfaces at right angles are ground on the sample and their common edge is given a radius of curvature of 0.5-1 mm. This edge is placed vertically, opposite a stationary Cu electrode. A Sventitsky a.-c. arc at 8 amp. is used for excitation. Detns. accurate to less than $\pm 20\%$ are obtainable where Mn is between 0.02 and 0.15% by comparing Mn 4783.4 (A) with Fe 4786.8 (B), 4779.4 (C), and 4788.7 (D). At 0.06% Mn, A = C; at 0.08% Mn, A = D; at 0.15% Mn, A = B.
2611. BASAVILBASO, F. C.
 Application of Spectrography to the Analysis of Potable Waters.
Rev. obras sanit. nacion (Buenos Aires), 11, 74-7 (1947).
Chimie & industrie, 59, 362 (1948).
C. A., 43, 3951h (1949).
 Spectrographic analysis of potable waters can be carried out: (1) by using special diaphragms to obtain the spectrogram, in which case the lengths of the resulting lines, measured by means of suitable comparators, are proportional to the concn. of the element to be detd.; (2) by detg. the total quantity of lines of an element obtained for a given concn. of that element. The operation is carried out on a few mg. of the dry residue and the elements present in the water can be very rapidly detected and detd., even those present in quantities too small to be detd. by ordinary chem. analysis. The accuracy of the method is only about 5-10%, and it is more suitable for metallic than for nonmetallic ions.
2612. BAYLISS, N. S. AND DAVID, D. J.
 Use of Filter Paper Pellets in the Spectrochemical Analysis of Solutions.
Nature, 160, 334-5 (1947).
C. A., 41, 7297f (1947).
 The technique of preparing suitable pellets is explained.
2613. BERNANOSE, A.
 Study of the Spectral Sensitivity of Photographic Plates as a Function of the Duration of Exposure.
Sci. ind. phot., 18, 289-94 (1947).
C. A., 42, 1137i (1948).
 Tests were made to det. the validity, in photographic spectrophotometry, of comparing spectrograms obtained with very different exposure times. With Guilleminot "2000 H & D" antihalo panchromatic plates, the variation with exposure time between 30 and 600 sec. was smaller than the exptl. error. At longer exposure times, B. observed an increase in γ which prohibits strict comparison.
2614. BERTON, A.
 Determination of Chemical Elements by Means of Spark Spectra Using Paper to Support the Substance to Be Analyzed.
Compt. rend., 225, 289-90 (1947).
C. A., 42, 2204i (1948).
 A paper band is impregnated with material to be tested, dried, and passed at const. speed between graphite electrodes on a sort of small horizontal drum. The paper is carbonized locally by the spark and the impregnating substance is volatilized. The spectrum standards vary regularly with concn. and are reproducible. The method was used to det. elements in mineral or biol. solns.
2615. BERTRAND, G. AND BERTRAND, D.
 Studies on Rubidium in Cryptogams.
Ann. agron., 17, 323-8 (1947).
C. A., 42, 2645h (1948).
Cf. C. A., 41, 5922i.
 The presence of Rb in the 81 species of cryptogams analyzed and in the 105 phanerogams analyzed previously (cf. C. A. 40, 3798*) suggests that Rb may occur generally in plants. (See C. A. for further details.)
2616. BERTRAND, G. AND BERTRAND, D.
 Rubidium in Phanerogams.
Ann. inst. Pasteur, 73, 472-7 (1947).
C. A., 41, 5923a (1947).
 The proportion of Rb contd. in the different parts of the phanerogam plants varies from 1 to 100 mg. per kg. of dry material. The av. is usually 15 to 30 mg. and the extreme amt. is exceptional. Most important is the fact that Rb is present in all 120 species of plants and in all the parts of the plants studied. In *Ann. agron.*, 17, No. 2, 149-51 (1947) (cf. C. A. 40, 1561*).

2617. BERTRAND, G. AND BERTRAND, D.
Rubidium in Cryptogams.
Ann. inst. Pasteur, 73, 797-803 (1947).
C. A., 45, 1651d (1951).

Analyses for K, Na, and Rb are given for fruits of numerous flesh fungi and also for some lichens, mosses, and algae. Rb was present in all specimens, the fungi averaging 150 mg./kg. dry wt. as compared to 30 for other organisms. Representatives of 2 genera of Basidiomycetes, namely, the genera *Cortinarius* and *Tricholoma* accumulate outstanding amts. of Rb, up to 1.51 g./kg. dry wt.

2618. BERTRAND, G. AND BERTRAND, D.
Is Rubidium Replaced by Cesium in *Chlora Perfoliata*?
Compt. rend., 225, 1232-4 (1947).
C. A., 42, 3032b (1948).
Cf. *C. A.*, 41, 5922i, 5923a.

The Rb content of 3 plant species ranged from 5.7 to 31.0 ppm. No Cs was identified. It is difficult to distinguish Cs 4554 from Ba 4555 Å spectrographically.

2619. BHADURI, B. N.
Reproducibility Tests of Sparking Technique in Laboratory Practice.
J. Sci. Ind. Research (India), 6, No. 4, B, 55-6 (1947).
C. A., 41, 7296g (1947).

A condensed spark for analyses of steel was used, and sparking technique on which analysis was based was standardized by the spectrograph at the following values: primary voltage = 230 v.; secondary voltage = 15,000 v.; capacitance = 0.005 farads (15,000-v. spark; 22,000-v. wave peak). The spark gap was 2 mm. The pre-sparking was for 2 min. Sparking was continuous. The spectra of test pieces were distributed evenly over the plate. Standard samples of high-speed tool steel were used for plate calibration and for evaluating V in the test piece. Process plates and developer ID-13 were used. Photometric measurements were made and these values are comparable with those obtained by chem. analysis (1.25%). The standard deviation is about 4% max. of the V content. The accuracy is sufficient for practical purposes and the technique is reliable.

2620. BILLINGS, M. P. AND RABBITT, J. C.
Chemical Analyses and Calculated Modes of the Oliverian Magma Series, Mt. Washington Quadrangle, New Hampshire.
Bull. Geol. Soc. Am., 58, 573-96 (1947).
C. A., 42, 1849g (1948).

Analyses with spectrographic detns. of 44 trace elements were made of six representative specimens from each of the six map units of the Oliverian series. K is systematically higher than Na. Increase of Si, which ranges

from 56 to 75%, is accompanied by the usual variation of the other principal oxides; Ca, Mg, and Fe decrease in the more siliceous rocks, whereas K and Na at first increase, then decrease. K is 1.5 to 3% greater than Na throughout the series. With increasing SiO₂, Cr, Ni, Sr, V, and Ba decrease but Zn increases. Comparisons with other parts of the world, especially N. W. Europe, suggest some systematic differences from New Hampshire. Calcn. of modes from the analyses shows an unexplained excess of Al₂O₃, ranging from 0.0 to 1.0%, possibly owing to more sericite and clay minerals in the rocks than the H₂O content suggests. The methods and possible errors of the calcs. are discussed.

2621. BLAIR, T. S.
Quantometer Speeds Aluminum Alloy Analyses.

Iron Age, 160, No. 25, 65-7, 135 (1947).
C. A., 42, 799h (1948).

A Quantometer is a direct-reading spectrometric analyzer. The compn. of a prep. sample can be detd. in about 45 sec. The high sensitivity of the spectrometric method is maintained except that in the extreme lower limit of measurement about 3 times the concn. of an element necessary to the best spectrographic methods is required. On the other hand, the uncertainties of the photographic phase of the ordinary process have been replaced with an elec. integrating device of high precision. Up to 16 elements are analyzable. Used in production the Quantometer will readily analyze 12 samples with an av. of 12 elements per sample in 1 hr. This represents 103,680 element analyses per month. The application of the instrument to the manuf. of Al casting alloys is described.

2622. BOETTNER, E. A. AND TUFTS, C. F.
A Study Concerning Characteristics of the High-Voltage Alternating-current Arc.
J. Optical Soc. Am., 37, 192-8 (1947).
C. A., 41, 3688h (1947).

This report covers the investigation of 8 factors and their effects on the reproducibility of intensity ratios of spectral lines when the high-voltage a.-c. arc is used as a source of excitation for quant. spectrochem. analysis. The factors considered are photometry, wt. of sample on the electrode, pre-burn time, exposure time, electrode sepn., arc current, inductance, and anion-cation effect. NaOH, NaCl, and CaCO₃ are employed for the work on the first 7 factors. In the investigation of the anion-cation effect, 8 inorg. salts are used. In conclusion there is a short discussion about data taken by a direct reading technique employing multiplier phototubes. Here an attempt is made to study short-period variation in intensity ratio rather than the integrated effects produced with photo-

graphic plates. Variations in wt. of sample on electrode, pre-burn time, exposure time, and added inductance have no effect on log ratio in the analysis of NaOH. Small variations in arc gap have no effect on log ratio in the analysis of NaOH, NaCl, or CaCO₃. However, a gap of 1.0 ± 0.1 mm. is used to obtain spectra of uniform intensity on the photographic plate. Small variations in current through the arc have no effect on log ratio in the analysis of NaOH and CaCO₃. However, the current is held to within ± 0.1 amp. to obtain spectra of uniform intensity on the photographic plate. In a test of 8 salts to det. the effect of anions or cations on the precision of analysis, all were found to be similar with the exception of copper chloride, whose reproducibility is very poor. Modifications in the app. used to make the short-period study are necessary before definite conclusions concerning this portion of the study can be reached.

2623. BONSACK, W.

The Quantometer — A Tool for the Metallurgist.

Metal Progress, 52, 975-8 (1947).

C. A., 42, 799g (1948).

The use of a direct-reading spectrometer for detg. 20 individual elements in light alloys is described. Light from a single selected spectral line cast by each element is absorbed by an individual photoelec. cell and the current generated is multiplied by electron tubes so as to drive a counter and indicate the compn. on a printed tape. Improved control of refining operations has been obtained.

2624. BOROVIK, S. A. AND INDICHENKO, L. N.

Spectrographic Analysis of Microscopic Inclusions, Sediments, and Precipitates.

Zhur. Anal. Khim., 2, 229-30 (1947).

C. A., 43, 6933i (1949).

Microscopic quantities of materials are successfully analyzed spectrographically by making certain changes in the C electrodes which must be very pure. The depression in the lower electrode is made meniscus-shaped. The upper electrode is made to fit the cavity of the lower electrode snugly. It is advisable to scratch grooves with a needle in the bottom of the lower electrode cavity. The analyzed material is placed in the bottom of the cavity and ground into the electrode with the upper electrode. In making the spectrogram the max. light delivered by the arc is used. With these improvements the min. quantities detd. were: Mo in molybdenite $3 \cdot 10^{-6}$, Sn in cassiterite $1 \cdot 10^{-6}$, Be in phenacite $0.5 \cdot 10^{-6}$, Pb in galenite $11 \cdot 10^{-6}$, W in scheelite $70 \cdot 10^{-6}$, and As in arsenopyrite $54 \cdot 10^{-6}$ g. The min. quantities of Ag, Fe, and Cu detd. by this method in galena were $8 \cdot 10^{-9}$, $10 \cdot 10^{-9}$, and $9 \cdot 10^{-9}$ g., resp.

2625. BOWEN, B. W.

Spectrograph in Steel Plants.

Steel, 121, No. 26, 69-72 (1947).

C. A., 44, 4824h (1950).

The use of a new direct-reading spectrograph permits 5 or more elements to be estd. in 5 min. and thereby affords more time for modifying the bath compn.

2626. BRAUDO, C. AND CLAYTON, H. R.

An Improved Spectrographic Source.

J. Soc. Chem. Ind. (London), 66, 259-67 (1947).

C. A., 42, 1510i (1948).

The requirements for a spectrographic source of stable characteristics are discussed, and a low-voltage controlled a.-c. arc which fulfills these conditions is described in detail. This circuit has been tested by analyzing 65 samples of a strong alloy to Specification 5L3 (Si, Fe, Cu, Mn, Mg) and 107 samples of commercially pure Al (Si, Fe, Cu, Mn, Mg). The standard deviations of the results indicate that this source is a substantial improvement over the condensed-spark source usually employed. A brief discussion is given of the processes in the analytical gap as they affect the choice of circuit conditions and of the considerations involved in the selection of spectrum line pairs for use in analytical spectrography. For precise stabilization achieved by accurate control of the triggering frequency and voltage, electronically controlled equipment is preferred to that employing synchronous interrupters or other less-accurate methods of timing.

2627. BRECKPOT, R.

The Spectral Analysis of Uranium Oxide.

Congr. avance méthod. anal. spectrograph. produits mét. (Paris), 8, 33 (1947).

C. A., 42, 8710b (1948).

A systematic study has been made to det. the most favorable conditions for the preferential excitation of the impurity lines of U and other refractory elements. Part of the method of fractional sublimation already used by Scribner has been used but with new entrainment agents. In₂O₃ and AgCl gave the best results. A part of the selective excitation method in the presence of large amts. of alk. salts, notably K₂CO₃, has been studied. Even when the spectrum of U is strongly depressed, Mo, Pb, Bi, and several other elements are sharply brought out. The Mo, the principal impurity of U, is revealed in a particularly interesting fashion. These 2 methods have been extended to Th and La. They have not succeeded with Cb, Ta, and W.

2628. BRECKPOT, R.

New Methods of Spectro-oscilloscopic Analysis.

Congr. avance méthod. anal. spectrograph. produits mét. (Paris), 8, 35 (1947).

C. A., 42, 8695d (1948).

An improvement has been applied to the method of Dieke and Crosswhite by replacing the mech. interrupter by an electronic one. Two lines to be compared, recorded on electron multiplier tubes, are indicated on the screen by two horizontal traces, more or less stretched, whose relative unwedging, measured from a common zero, is a function of the concn. In the second method, an integration in the time is obtained by introducing into the anode circuit of the electron multiplier a capacity mounted in parallel with a pair of the plates of the oscilloscope. The charge of the condenser is interrupted as soon as the luminous spot has reached a datum traced on the fluorescent screen. Because of the automatic interrupter, 2 points, corresponding to 2 lines, are followed simultaneously and their relative position up to the end of the expt. is a function of the concn.

2629. BRITSKE, M. E., IVANTSOV, L. M., AND POLYAKOVA, V. V.

Spectral Analysis of Bronze and Tin and the Sorting of Ferrous and Nonferrous Alloys.

Bull. acad. sci. U.R.S.S., Sér. phys., 11, 283-7 (1947).

C. A., 42, 1845f (1948).

A rapid method for detg. Sn, Zn, and Pb bronze is described. The instrument used was a steelscope transformed into a spectrograph by addn. of a holder for photographic plates. Homologous pairs and characteristics of the discharge are indicated. The results obtained in detg. Cu and Fe in Sn metal are also given.

2630. BRUCELLE, G.

Search for an Operating Procedure Suitable for the Quantitative Spectrographic Analysis of High-speed Steels.

Congr. groupe avance. méthod. anal. spectrograph. produits mét. Paris, 8, 39-45, 137-75 (1947).

C. A., 42, 3697h (1948).

The use of a counter-electrode of Al in spark spectroscopy gives good results under usual conditions of excitation and study for ordinary steels and those alloy steels contg. Ni, Cr, or Mo, but not for high-speed steels. For the latter, a counter-electrode of Cu is satisfactory and gives results of the same order of precision as the use of two electrodes of the steel being analyzed, and much better than a counter-electrode of Al or pure Fe. The counter-electrode in each case is the upper electrode.

2631. BRYAN, F. R. AND NAHSTOLL, G. A.

A Method for Micro-Spectrography of Metals.

J. Optical Soc. Am., 37, 311-16 (1947).

C. A., 41, 4399d (1947).

Qual. spectrographic analyses of metallic areas of less than 0.05-mm. diam. can be obtained by means of the equipment and methods described. The app. consists of a device for holding a counter electrode and the specimen to be analyzed, an electronic spark generator, and a medium-size quartz spectrograph. One monocular system of a binocular microscope was removed and replaced with a quartz tube with a capillary bore. The lower end of the tube was ground almost to a point and the very end fused until an opening of only 0.01 mm. remained. A fine Al wire which served as the counter electrode was inserted into the capillary to within 0.5 mm. of the restricted opening. The specimen to be analyzed was placed on a stage directly beneath the capillary opening so as to provide an analytical gap of about 1 mm. The remaining microscope ocular was used for observing and manipulating the specimen during the sparking. The spark was placed directly in front of the entrance slit of the spectrograph and the spectra were photographed with exposures of an hr. or more. Small areas such as inclusions, segregations, cryst. phases, surface contaminations, metallic coatings, and the extent of metallic diffusion have been successfully analyzed.

2632. BRYAN, F. R. AND NAHSTOLL, G. A.

Quick Analyses of Magnesium Foundry Heats.

Materials & Methods, 25, No. 2, 90-2 (1947).

C. A., 41, 2285b (1947).

Direct-reading spectrographic equipment is described for use with Mg alloys contg. Al, Zn, Mn, Si, Cu, Ni, Fe, and Pb. Results can be obtained quickly and in advance of pouring the metal.

2633. BURDETT, R. A. AND JONES, L. C., JR.

Analysis of Silica-alumina Cracking Catalysts. Spectrographic Determination of Contaminants.

Anal. Chem., 19, 238-41 (1947).

C. A., 41, 3399e (1947).

By the high streaming velocity system of Hasler and Harvey (*C. A.* 35, 6211*) it is possible to det. impurities contg. Na, Fe, V, Ni, and Cu simultaneously in $\text{SiO}_2\text{-Al}_2\text{O}_3$ cracking catalysts. A mixt. of about 0.2 ml. of the catalyst mixed with an equal vol. of pure NH_4Cl is transferred to an all-graphite center-post electrode and arced against a 2-mm. graphite upper electrode. The rotating-sector is used in all cases. The spectrograph used was the Applied Research Labs.-H. W. Dietert grating spectrograph fitted

with a 24,000 line-per-in. grating and with a 1-5 meter radius of curvature. The A.R.L.-Dietert Multisource unit was used to excite the spectra and the input voltage was held at 230 v. by a G. E. const.-voltage transformer. The films were processed at 18.5°. Only about 30 min. is required for an analysis when the Na content exceeds 0.1%.

2634. BUYANOV, N. V., LUTSENKO, A. V., AND SOROKINA, N. N.

Spectral Determination of Small Quantities of Boron, Vanadium, Titanium, and Aluminum in Steel.

Zavodskaya Lab., 13, 447-51 (1947).

C. A., 43, 964f (1949).

Detns. were made with a Q24 spectrograph, with a-c. arc, gap of 2 mm., and 15 amp. A Zeiss three-lens arrangement was used for the illuminating system; a revolving diaphragm was mounted on the second lens which made it possible to use only the central portion of the flame. Photography of spectra was on diapositive plates, and the exposure was 45 sec. Photomentering and detn. of concns. were made by photometric interpolation. The use of a microphotometer in this case was found to be impossible because of the narrow slit of the spectrograph. The standards which were used to prep. the empirical curves were from C steel contg. approx. C 0.5, Si 0.25, Mn 0.7, Ni 0.05, Cr 0.05, P 0.04, S 0.04, and Cu 0.005%. As for the content of V, Ti, Al, and B, the standards were selected to cover the concns. required for analysis. Error was $\pm 15\%$ for concns. of 0.001-0.01% and $\pm 5.5\%$ for 0.01-0.1%.

2635. CARLSSON, C. G. AND RYNNINGER, R.

Spark and Arc Circuits for Spectrographic Analysis.

Jernkontorets Ann., 131, 1-25 (1947).

C. A., 41, 2942e (1947).

A survey of the different elec. circuits used in spectrographic analysis. A first group consists of self-igniting (high-tension) spark, either of the uncontrolled type (free spark) or controlled by a rotating interrupter or an auxiliary spark gap (tandem spark), preferably with a large inductance or resistance across the analysis gap. In the first case the energy in each spark is affected by variations in the width of the gap, in the second by variation in the voltage of the mains, while in the third case these factors have no effect. A second group of light sources consists of sparks made by discharging a condenser charged to a voltage lower than the breakdown voltage of the analysis gap, the discharge being triggered by a superimposed high-tension spark of low energy. A comparison is made between the different light sources with regard to the characteristics of the single spark, essentially its frequency and damping, which together det. the time of action of each spark, and the

initial current, which is of importance to the character of the spectrum. It is shown that with the triggered discharge sparks similar to those of the self-igniting type can be obtained, as well as discharges giving spectra of the same kind as a d.c. arc, and, in addn. to this, different intermediate forms. In the first case the voltage must be comparatively high, 5-10 kv., and the condenser small, in the second case the condenser must be large. With an infinitely large condenser, which is equal to the d.-c. mains, a d.-c. arc is obtained. Thus this old light source appears as a special case of the triggered spark. The triggered spark is extremely versatile and will probably be much used in the future.

2636. CAROBBI, G. AND PIERUCCINI, R.

Spectrographic Analysis of Tourmalines from the Island of Elba, with Correlation of Color and Composition.

Am. Mineral, 32, 121-30 (1947).

C. A., 41, 3716e (1947).

Qual. spectrographic analyses are given for 20 pure samples of different colors. In addn. to the normal constituents Si, B, Al, and Na, the following elements were detected: Ti, Fe, Ni, Mg, Cu, Mn, Ca, Ba, K, Li, Cs, Be, V, Ta, Sc, Sn, and Ce. The relation between color and compn. is discussed. Conclusion: The green color is due to bivalent Fe, pink to Mn, and blue to Cu.

2637. CARPENTER, R. O'B., DUBOIS, E., AND STERNER, J.

Direct-reading Spectrometer for Ferrous Analysis.

J. Optical Soc. Am., 37, 707-13 (1947).

C. A., 42, 5b (1948).

The direct-reading spectrometer, previously described by Sanderson, Caldecourt, and Peterson of the Dow Chemical Co. (cf. *C. A.*, 40, 1090^a), has been adapted to ferrous analysis. Data are given on reproducibility of analytical results obtained for Ni, Cr, Si, Mn, Cu, Mo, Al, and Sn in steel.

2638. CASTRO, R.

Report on the Experiments Carried Out with the Spark Source for Spectrography Constructed by Mr. R. Durr of Section of Spectrum Analysis, Research Laboratory of Acières d'Ugine at Albertville.

Congr., groupe. avance. méthod. anal. spectrograph. produits mét. 7th Congr., Paris, 1947, 79-87.

C. A., 42, 826h (1948).

The principle and the construction of the Durr source unit are discussed, and a detailed comparison of the Durr and Feussner units is presented. The expts. carried out with the former are discussed. It is con-

cluded that the Durr unit is superior to the Feussner unit.

2639. CASTRO, R. AND PHÉLINE, J. M.

The Present Stage of the Work Concerning the Spectrographic Analysis of Ordinary and Special Steels, Carried Out in the Research Laboratory of the Aciéries électriques d'Ugine.

Congr. groupe. avance. méthod. anal. spectrograph. produits mét. 7th Congr., Paris, 1947, 25-49.

A brief review is given of the spectrochem. detn. of Si, Mn, Cr, Ni, Cu, Mo, Ti, W, and Al in common steels. The spectrochem. analysis of stainless steel (American Standards of Am. Iron and Steel Inst. Nos. 304, 316, 430) is discussed and the working details are given for the detn. of Si, Mn, Ni, Cr, Ti, Mo, and Cu by means of spark spectra in the ultraviolet and in the visible region. The difficulties and sources of error encountered in the work are discussed. The agreement between the values obtained by the use of chem. and spectrographic methods was found to be good. The detn. of W, Cb, and Ta in steels is also described, based on the detn. of the sum of WO_3 , Cb_2O_5 , and Ta_2O_5 , and of total Fe by chem. means, and the W:Fe ratio, from which the percentage of W is obtained, by the spectrograph, and the detn. of Ta or Cb from the difference. The W:Fe ratio is detd. in the ultraviolet region with interrupted a.-c. arc or spark excitation.

2640. CASTRO, R. AND PHÉLINE, J. M.

The Spectrographic Determination of Alumina in Residues of Metallic Oxides. Application to the Determination of Oxygen in Special Steels.

Compt. rend., 225, 633-5 (1947).

C. A., 42, 2206h (1948).

Al is detd. in the presence of Cr and other metals which may be present in steels by a spark spectrum between Cu electrodes. Co is used as an internal standard. The mean square error detd. statistically for many spectra is 2-3.5%.

2641. CASTRO, R. AND PHÉLINE, J. M.

The Spectrographic Determination of Copper Contained in Low Concentrations in Iron and Steel.

Spectrochim. Acta, 3, 18-39 (1947).

C. A., 42, 2541h (1948).

Details and directions are given for the spectrographic detn. of small amts. of Cu in steel in the form of massive pieces or sheets. The spectra are excited in a controlled spark or in an interrupted arc and are photographed with a Zeiss Qu 24 spectrograph. The spark plays between a flat surface to be analyzed and a counter electrode of pure Al. Calibration was carried out with synthetic

solns. Analyses were also made from absorption measurements based on the coloring of hydorrubeanic acid by Cu. The proposed methods of analysis permit the detn. of Cu between 0.010 and 0.100% with an error of less than 10% of the amt. present.

2642. CHAPMAN, C. A. AND SCHWEITZER, G. K.

Trace Elements in Rocks of the Oliverian Magma Series of New Hampshire.

Am. J. Sci., 245, 597-613 (1947).

C. A., 42, 496i (1948).

Petrographic and spectroscopic analyses are given of 21 specimens taken from an intrusive body in west-central New Hampshire. The rock ranges from quartz diorite to granite. Tables giving λ for the lines and also relative densities as light, medium, heavy, and very heavy are shown. Elements listed are: Be, Mg, Sr, Ba, Cd, Ge, Pb, Ti, Zr, V, Cr, Mo, Mn, Ni, Ru, Rh, Ir, and Pt. A table of replacement agents is also given. There was a marked uniformity in the intensity of any one line except for Sr, which was very variable but in general was more abundant in K feldspar-rich rocks. The spectroscopic data check well with the petrographic data.

2643. CLAFFY, E. W.

Spectrochemical Analysis of Rocks and Minerals.

Am. J. Sci., 245, 35-48 (1947).

C. A., 41, 6490h (1947).

The application of spectrochem. methods to rock and mineral analysis is described. The general principles of the d.-c. carbon-arc method are outlined in considerable detail, since it is uniquely adapted for the analysis of the refractory and powd. samples encountered in the geol. lab. The influence of state of combination and sample matrix on spectral line intensities is illustrated for Sn. The matrix has little or no effect on Sn line intensity (relative to Fe 3034.1) when Sn is present as SnO_2 in amts. below 1%. At a higher conc. however, a quartz-feldspar- Fe_2O_3 base produces more intense Sn lines than does a Mg-Fe borate (natural mineral ludwigite). Greater Sn line intensities were found at all concns. when tin was present as hulsite.

2644. CORLISS, C. H., ET AL.

Standard Samples for Spectrochemical Analysis.

Am. Soc. Testing Materials, Tech. Pub., No. 41-B, 1-23 (1947).

C. A., 42, 1147e (1948).

A survey is made of the available standard samples for use as electrodes in spectrochem. analysis. These standards comprise: (1) Fe and steel; (2) Al and its alloys; (3) Mg and its alloys; (4) Zn, Pb, and Sn alloys; (5) Cu

alloys; (6) miscellaneous materials. When the compn. of the sample is certified by a recognized standardizing agency or group generally as the weighted result of 2 or more independent labs., and when, in addn., the reliability and limitations of its applications to the intended analytical procedures have been detd., it is classified as a primary standard. It is classified as a secondary standard when the compn. is detd. by a single reputable lab. without independent check, or when it has not been investigated thoroughly to det. its reliability and limitations under varied conditions of application even though its compn. is well established. A sample that can be employed usefully for comparison purposes in analysis but has not attained the status of a primary or secondary standard is classed as a reference sample. These different standards can be further qualified according to their specific applications in analytical procedures as: (1) nominal compn. standards; (2) analytical range standards; (3) specification limit standards; (4) working standards; (5) control standards. In 14 tables are listed the available standards of the groups and classifications stated above, their compns., form and dimensions, lab. of origin, and where procurable.

2645. CORNU, A.

The Use of a Slitless Spectrograph for Spectrographic Analysis.

Congr. groupe avance. méthod. anal. spectrograph. produits mét. Paris, 8, 29-32 (1947).

C. A., 42, 3692g (1948).

The slit of a conventional spectrograph is replaced by a cylindrical rod of stainless steel or other reflector, carefully ground, polished, and mounted in the focus of the collimator parallel to the refracting edge of the prism. Light is reflected by the rod giving an image which is the virtual source of light for the spectrograph. For equiv. light sources a greater amt. of luminous flux is available than with a conventional slit spectrograph. Masking, to limit the height of spectral lines, is conveniently accomplished by means of a black paper sleeve, with suitable openings, which slips over the rod. Two sources disposed symmetrically on opposite sides of the rod can be observed simultaneously, but with corresponding lines displaced laterally by a few mm. This effect is used in a successful analytical method in which one source is a spark struck between standard electrodes, the other an exactly similar spark between electrodes of the material to be examd. The two sparks are energized alternately by a high-speed commutator. The resulting double spectrum is analyzed by detg. the relative ds. of the 2 lines of a pair by means of a photometric arrangement, with two identical electron-multiplier tubes connected in opposi-

tion. One light source is moved along an optical bench to such a distance from the reflecting rod that the intensity of the line as observed is equal to that from the second source.

2646. COULLIETTE, J. H.

The Spectrographic Analysis of Ferrosilicon.

J. Optical Soc. Am., 37, 609-13 (1947).

C. A., 41, 6493c (1947).

A method has been devised for detg. the metallic constituents of ferrosilicon spectrographically at the rate of 3 samples per hr. The mutual standard method is applied for the spectrochemical analysis of materials consisting of 2 or more principal constituents. One of the components serves as a reference element, and the ratios of the concns. of the various component elements to the concns. of the reference element in a set of standard samples are computed. These concn. ratios are plotted against spectral-line intensity ratios to form the working curves. From the intensity ratios for an unknown sample, its compn. is readily calcd. by means of a set of simple equations. Use of this method obviates the necessity for adding a standardizing element to the sample or making approximations to correct for reference element diln.

2647. DANILOVA, V. I.

The Width of the Lithium Line at 4132 Å and the Electron Concentration in the Arc Discharge.

Bull. acad. sci. U.R.S.S., Sér. phys., 11, 252-9 (1947).

C. A., 42, 1817c (1948).

A d.-c. arc was struck between C electrodes. A channel in the electrodes was filled with a mixt. contg. 10% Li_2CO_3 with variable amts. of Na_2CO_3 , K_2CO_3 , and ZnSO_4 . It was found that the width of the 4132-Å line is linearly dependent on the conc. of K and Na and independent of the Zn concn. This is due to a change in the diam. of the arc and therefore to a change in c.d. and electron concn. Zn does not increase the diam. because of its high ionization potential. Variation of c.d. at const. concn. of salts changes the diam. of the arc for Zn and does not affect the diam. in arcs contg. Na and K. The width of the line is linearly proportional to the c.d. The temp. of the pos. electrode was detd. to be 5480°K. by the relative intensities of the lines Cu 5153 and 5105 Å. On assuming that the widening of the line is due to collisions with electrons the electron concn. calcd. from the equation of Unsöld (*Z. Astrophysik*, 12, 56 (1936)) is substantiated by expt.

2648. DRÁN GUEL BENZU, M., SANTOS RUIZ, A., AND LOPEZ DE AZCONA, J. M.

Spectroanalytical Study of Absorption and

Localization of Trace Elements in Lens Esculenta.

Anales real acad. farm., 13, 269-81 (1947).
C. A., 42, 3463b (1948) and *C. A.*, 44, 2602a (1950).

Periodic semiquant. spectrographic detns. are carried out on samples of soil, seeds and organs of the growing leguminous *Lens esculenta*. The tabulated results conform with previous similar findings: the amt. of Fe in the ash is considerably larger than the amt. of Cu, higher concn. of Fe is found in organs of more active metabolism; Ni appears in quantities approx. ten times larger than Co. There seems to be an enrichment of trace elements in subterraneous organs. Several of the findings await confirmation by applying quant. methods.

2649. DOBRINSKAYA, A. A. AND GUREVICH, I. M.

The Spectrographic Determination of Potassium in Solutions.

Zavodskaya Lab., 13, 216-19 (1947).
C. A., 42, 4490i (1948).

Place an aliquot of a soln. contg. less than 0.14 mg. KOH in a cavity in a Cu electrode and burn 30 sec. at 5 amp. with a Sventitsky low-voltage a.-c. arc. Log (K 4047.2/Cu 4022) plotted against log % K, gave a straight line between 0.6 and 1.1% K, Na and Pb did not interfere. The probable error for 50 detns. on a single soln. was 3.9%.

2650. DUBROVSKAYA, O. N.

The Use of Aluminum and Magnesium Electrodes for the (Spectrographic) Determination of Nickel in Steels.

Zavodskaya Lab., 13, 228-31 (1947).
C. A., 42, 2888f (1948).

The intensity ratio Ni 2992.6/Fe 2990.4 is plotted as a function of pre-arcing time for flat and pointed Al and Mg auxiliary electrodes. This ratio reached a plateau after the following pre-arcing times for the auxiliary electrodes indicated: pointed Al 40 sec., flat Al 60 sec., pointed Mg 10 sec., flat Mg 15 sec. A Sventitsky a.-c. arc was used at 5 amp.; the analytical gap was 2.5 mm.

2651. DUSSOURD, E.

The Grating Spectrographs from Applied Research Laboratories (A.R.L.) of De-troit.

Congr., groupe. avance. méthod. anal. spectro-graph. produits mét. 7th Congr., Paris, 1947, 71-8.

C. A., 42, 826g (1948).

The properties of the above types of grating spectrographs are compared with those of a large quartz spectrograph, Littrow type; the spectrographic techniques are discussed. The Quantometer for the direct recording of

the percentages of elements investigated by spectrochem. means is described with refer-ence to the working methods. The results of the detn. of Cu, Mg, and Fe in an Al alloy and of Ni, Cr, Mn, Mo, Cu, Sn, V, and Si in steel are presented.

2652. EFENDIEV, F. M.

Combined Spectral and Chemical Analysis of Microelements.

Bull. acad. sci. U.R.S.S., Sér. phys., 11, 313-18 (1947).

C. A., 42, 1843e (1948).

To det. small quantities of elements in soils, ores, etc., they must first be obtained in solns. of solvents which are easily evapd. in the dis-charge. The sensitivity of the results toward different light sources was studied for detg. Li, Na, K, Cs, Cu, Ag, Au, Mg, Ca, Sr, Ba, Zn, Cd, Hg, Ga, In, Tl, Ge, Sn, Pb, Bi, As, Sb, Mo, Co, Pt, and Ni. It was found that the best results were obtained with an arc of 10-12 kv., 20-30 ma. without inductive or capacitive load. W, Ta, Th, U, Zr, and other refractory elements show poor sensitivity. A simple method of analysis has been worked out: A spectrogram of the soln. to be ana-lyzed is first taken and then the test is re-peated after addn. of a soln. contg. a known quantity of the metal to be analyzed.

2653. EFENDIEV, F. M.

The Influence of Anions on the Intensity of Spectral Lines of Elements.

Zavodskaya Lab., 13, 1492-3 (1947).

C. A., 44, 4328h (1950).

Solns. of the nitrates, chlorides, and sulfates of Cd, Au, Zn, Ni, and In, and of the iodides of Cd, Au, and Zn were exposed spectro-graphically. No influence was observed when the soln. was fed into either a high-voltage arc or a condensed spark with a Nedler-Efendiev fulgurator (*C. A.*, 38, 6231^a), but a diminution of intensity in the order of NO₃⁻, I⁻, Br⁻, Cl⁻, SO₄⁻⁻ was noted for all of the above metals when a spark was struck to the open liquid surface. No internal standard was used.

2654. EMIDIO BARBOSA, P., AND BARRETTO FILHO, L.

Qualitative and Semiquantitative Spectro-graphy. Limit of Identification.

Brazil, Ministério agr., Dept. nac. produção mineral, Lab. produção mineral, Bol. 26, 25-51 (1947).

C. A., 43, 7858g (1949).

The wavelength, concns. of 10, 1, 0.1, 0.01, 0.001%, interferences, and observations of the following elements are tabulated: Ag, Al, As, B, Ba, Be, Bi, Ca, Cd, Co, Cr, Cu, Fe, Ge, K, Li, Mg, Mn, P, Pb, Sb, Si, Sn, Mn, Mo, Na, Nb, Ni, Sr, Ta, Ti, Tl, W, Zn.

2655. ENGSTROM, R. W.

Multiplier Phototube Characteristics: Application to Low Light Levels.

J. Optical Soc. Am., 37, 420-31 (1947).

C. A., 41, 5795i (1947).

Measurements in such fields as photometry, spectrometry, and astronomy, dealing with very low light levels, may be assisted by the use of photomultiplier tubes. Spectral characteristics of visible (S-8), blue (S-4), and ultraviolet (S-5) sensitive multiplier tubes are presented. Data are shown illustrating the wide range of linearity of photomultiplier types 931-A, 1P21, 1P22, and 1P28. The tubes are linear at currents up to the point where space charge in the output stages reduces the ratio of anode current to cathode light flux. Dark currents and the limitations which they introduce in practice are discussed. Fatigue effects are discussed and data shown which indicate good stability at low current levels. The ultimate sensitivity of these tubes when refrigerated to various degrees has been investigated; with suitable precautions, pulses attributable to individual photoelectrons can be counted.

2656. FAST, E. AND NIELSEN, J. R.

The Effect of Alkali and Alkaline Earth Salts on the Spectrographic Determination of Strontium.

J. Optical Soc. Am., 37, 614-22 (1947).

C. A., 41, 6489c (1947).

In connection with an attempt to develop a method of quant. spectrographic analysis of oil-field waters a detailed investigation was made of the detn. of Sr in the presence of alkali metals and of other alk. earth salts. The dried salts, together with a powdered graphite buffer and Ti as internal standard, were placed in cupped water-cooled graphite electrodes of a high-voltage a.-c. arc regulated by a variable inductance in the primary circuit. The spectrum was photographed with a Hilger B1 quartz spectrograph, and the intensities of Sr 3380.7, Ti 3383.8 and Ti 3387.8 Å were detd. by means of a step sector and a Dietert densitometer. With const. amts. of SrCl₂ and TiO₂ and various amts. of NaCl, KCl, CaCl₂, BaCl₂, or MgCl₂, exposures were made at different times after the arc was started, and the intensities were detd. In all cases the intensity ratios between Sr and Ti lines were most const. during the period from 2 to 10 min. after the arc was started. Hence, the weighted averages of the intensity ratios observed during this period were studied as functions of the amt. and compn. of the extraneous salts. With NaCl added, the intensity ratio Sr 3380.7/Ti 3383.8 has a max. value twice as great as when no extraneous element is present, with MgCl₂ sixteen times as great. When an alk. earth is added, the concn. of the extraneous substance giving the max. value

of Sr/Ti intensity ratio decreases with at. wt. Alkalies show the opposite behavior. When the total concn. of CaCl₂ + NaCl is kept const. a max. of Sr 3380.7/Ti 3383.8 is found for a certain ratio of CaCl₂ to NaCl. On the other hand, when various mixts. of KCl and NaCl are added a min. value of this intensity ratio is obtained for a certain ratio of KCl to NaCl. In neither case are the effects of the extraneous substances additive.

2657. FISHER SCIENTIFIC COMPANY.

Flame Attachment Extends Usefulness of Spectrophotometers.

The Laboratory, 17, No. 3, 96-8 (1947).

(Fisher Scientific Co., Pittsburgh, Pa.)

A Flame Attachment for the Beckman Spectrophotometer has been developed that permits the quantitative determinations of more than thirty elements by emission-spectra. The apparatus consists of an oxygen-gas flame, in a water-cooled chamber, three atomizers employing conditioned compressed air for atomizing test and comparison solutions into the flame, and controls for adjusting gas pressures. Some of the more commonly determined elements and their minimum detectable amounts in parts per million are: sodium and lithium 0.1, potassium and calcium 0.5, manganese 1.0, copper 10.0, magnesium 25.0, nickel 40.0, boron and iron 50.0.

2658. FOLDVÁRI, A.

Postvolcanic Molybdenum Traces in the Velence Mountains.

Magyar Állami Földtani Intézet Evi Jelentése, Beszámoló, 9, 39-58 (in English, 53-6) (1947).

C. A., 43, 8321b (1949).

Mo was detd. on 75 samples with a Zeiss instrument with 3 glass prisms. The Mo line at 3864.1 Å was used, with the Co line at 3861.1 Å as internal standard. Mo was found (0.0001-0.008%) in 12 samples. The geology of the area is described. Contrary to the usual case, no Mo was found in granites and related rocks, but Mo was found in rocks related to andesitic eruptives and their post magmatic derivs. The highest Mo concns. were found in iron-bearing quartzites.

2659. FOLDVÁRI, M.

Examination of Molybdenum Content in Rocks of the Velence Mountains with Spectral Analytic Methods.

Magyar Állami Földtani Intézet Evi Jelentése, Beszámoló, 9, 21-33 (in English, 34-7) (1947).

C. A., 43, 8321b (1949).

2660. FRED, M., NACHTRIEB, N. H., AND TOMKINS, F. S.

Spectrochemical Analysis by the Copper Spark Method.

J. Optical Soc. Am., **37**, 279-88 (1947).

C. A., **41**, 3707e (1947).

A system of spectrochem. analysis is described in which 0.1 ml. of a HCl soln. of the sample is evapd. on the ends of a pair of flat-topped Cu electrodes which are then excited in a spark. Abs. sensitivities for different elements ranging from 10^{-10} to 10^{-6} g. were obtained. The lower limits measurable by visual comparison with standard plates are given for 64 elements. The accuracy can be increased, with some loss in sensitivity, by densitometry with an internal standard. In addn. to high sensitivity the method has the advantage that a great many elements can be detd. in one exposure, so that almost any sample which can be dissolved in HCl can be analyzed for impurities without special calibration. The method was developed for the analysis of plutonium samples.

2661. FULTON, S. C. AND HEIGL, J. J.

Spectroscopy in the Petroleum Industry.

Instruments, **20**, 35-8 (1947).

C. A., **41**, 2560g (1947).

A review describing the application of ultraviolet, infrared, Raman, and mass spectroscopy to the analysis of hydrocarbons, and of emission spectroscopy to the analysis of catalysts and metallic constituents in oils. Accuracy, utility, and speed with respect to conventional methods (chem. and distn.) are discussed.

2662. GABRIEL, A., JAFFE, H. W., AND PETERSON, M. J.

Use of the Spectroscope in the Determination of the Constituents of Boiler Scale and Related Compounds.

Am. Soc. Testing Materials, Proc., **47**, 1111-16 (discussion 1117-20) (1947).

C. A., **43**, 3309i, (1949).

A Bunsen spectroscope is useful in making qual. examns. of minerals to det. the presence of cationic constituents and to check the purity of ppts. The instrument can be applied to boiler scale in which ions such as Zn, Pb, Cu, Mg, and Al can be detected although not shown in conventional quant. tests.

2663. GARTON, F. W. J.

The Spectrographic Determination of Carbon in Steel.

Spectrochim. Acta, **3**, 68-88 (1947).

C. A., **42**, 2544b (1948).

The possibility of detg. C in steel by a spectrographic method using a simple condensed spark circuit has been investigated. Preliminary expts. with a rotating mirror were

carried out for the purpose of obtaining information concerning the nature of the uncontrolled spark discharge with and without an auxiliary spark gap, and of testing the effect of air blast across the analytical gap. Exptl. conditions favoring the emission of the C III line 2296.86 Å were worked out to form with the Fe III line 2295.86 Å a homologous pair. This method is valid for 0.2-1.2% C, and a standard deviation, per spectrum, of 3.7% of the C content is obtained. A no. of factors which might adversely affect the accuracy of the detn. were investigated. These included the effect of CO₂, the effect of size and shape of electrode, effect of grain size, direction of grain, nature of surface, and the effect of metallurgical history. The method is suitable for the simultaneous detn. of Mn, Cr, Ni, Si, Mo, and V.

2664. GATTERER, A. AND JUNKES, J.

Atlas of Persistent Spectra.

Specola Vaticana, Vatican City (1947).

I. Spectra of Thirty Chemical Elements. 53 pp., 28 charts.

C. A., **44**, 1329e (1950).

The arc and spark spectra are given for Ag, Al, Ba, Bi, C, Ca, Cd, Co, Cr, Cu, Mg, Mn, Mo, Ni, Pb, Rb, Si, Sn, Sr, Ti, Tl, V, W, and Zn. The arc spectra are given for Ba, Ca, Co, Cr, Mn, Mo, Ni, Rb, Sr, Ti, and V, and the spark spectra for Au, As, B, P, Pt, and Sb. The ultimate lines of Li, Na, K, and Cs are included as impurities in the spectrum of Rb.

2665. GAVELIN, S. AND GABRIELSON, O.

Spectrochemical Investigations of Sulfide Minerals from the Ores of the Skellefte District. The Significance of Minor Constituents for Certain Practical and Theoretical Problems in Economic Geology.

Sveriges Geol. Undersökn., Årsbok, **41**, Ser. C, No. 491, 45 pp. (1947) (in English).

C. A., **42**, 8114g (1948).

Spectrochem. analyses are given for Co, Ni and Mn in 134 samples of pyrite, 39 of arsenopyrite, 100 of pyrrhotite, and 32 of chalcopyrite. Work on sphalerite was previously reported (*C. A.*, **41**, 1963h). Co generally predominates over Ni in pyrite, pyrrhotite, and arsenopyrite, but the ratio Co:Ni varies even in samples from a single deposit. The order of ability to concentrate Co is arsenopyrite, pyrite, pyrrhotite, and chalcopyrite. For Ni the order is the same, except that pyrite and pyrrhotite are interchanged. The Mn contents of the 4 minerals show irregular and extreme variations. It is doubtful whether there is any systematic relationship between the Co-Ni-Mn values and different types of wall rocks. Co, Ni, and the ratio Co:Ni are higher in pyrrhotite from phyllites than in other pyrrhotites, but the genetic

significance of this is doubtful. Temp. of mineralization seems not to have been a significant factor. Where Zn and Cu ores occur in a single mine or district, Co is generally higher in minerals of the Cu ores, Ni is higher in minerals of the Zn ores. Sn was found almost exclusively in chalcopyrite of the Cu ores, but also occurs in pyrite of the Zn ores.

2666. GAZZI, V. AND GELLI, P.

Atlas of the Spectrum of the Iron Spark from 2227 to 4415 Å, in 13 Photographic Charts with Positions Indicated for Analytical Lines of 54 Elements.

Cesare Zuffi, Bologna (1947).

Spectrochim. Acta, 3, 121-2 (1947).

Recommended for laboratories that work with small or moderate dispersion.

2667. GENTRY, C. H. R. AND MITCHELL, G. P.

Spectrographic Analysis of a Complex Ferrous Alloy.

J. Soc. Chem. Ind. (London), 66, 226-32 (1947).

C. A., 42, 57i (1948).

A detailed description is given of a spectroscopic procedure for the analysis of Ticonal, an alloy contg. approx. Fe 50, Al 6-9, Ni 12-18, Ti 0-2.5, Si 0-0.5, Cu 2.5-5, Co 20-30, and Mn 0.1%. The precision of the method is shown to compare favorably with that obtained by routine chem. procedures. The method has been used for 2 yrs. The results of about 75 complete analyses are given, and the paper deserves study by all interested workers.

2668. GENTRY, C. H. R., NEWSON, D., AND RUSHMAN, D. F.

The Automatic Control of the Spectrographic Exposure.

J. Soc. Chem. Ind. (London), 66, 323-5 (1947).

C. A., 42, 1767c (1948).

An electronic circuit is described by which the following cycle of operations automatically occurs on initiation: the pre-spark starts, the spectrograph shutter opens after a fixed time, the plate remains exposed for the required period, then the shutter closes just prior to switching off the spark and the exposure times to be made. This device should relieve tiresome routine work in analyses, save time, and eliminate personal error.

2669. GILLIS, J.

Spectrochemistry — Its History, Its Development, and Its Applications.

Actes soc. helv. sci. nat., 127, 31-48 (1947).

C. A., 43, 1639h (1949).

23 references.

2670. GILLIS, J.

General Review of the Present Position of Quantitative Spectrographic Analysis.

Anal. Chim. Acta, 1, 38-49 (1947).

Ind. chim. belge, 12, 105-16 (1947).

C. A., 41, 4398i (1947).

A review with 76 references.

2671. GILLIS, J. AND BECKHOUT, J.

Quantitative Spectrochemical Analysis of Steel.

Anal. Chim. Acta, 1, 377-89 (1947) (in English).

C. A., 42, 4493h (1948).

Operating conditions are described for the spectrographic analysis of Fe- and C-steel by using solns. which are always homogeneous and make better av. samples than solids. The technique is based on the Scheibe and Rivas method; the Pfeilsticker interrupted a.-c. arc is substituted as light source. The Hilger medium spectrograph gave satisfactory results, and showed that an instrument of moderate dispersion can serve very well for the analysis of steel. A logarithmic step-sector run by a synchronous motor, with speed adjusted to that of the interruption of the arc, was used during the exposure, and each spectrum was photographed 4 times for 45 sec. The measurement of the spectra was carried out according to Breckpot's method. Analysis lines and standardizing tables are given for Al, As, Cb, Co, Cr, Cu, Mn, Mo, Ni, Ta, Ti, V, and Zr.

2672. GILLIS, J. AND BECKHOUT, J.

Spectrochemical Research at the University of Ghent.

Chem. Weekblad, 43, 387-93 (1947).

C. A., 41, 6169h (1947).

The aim is to det. by means of a single exposure all the spectroscopically detectable elements present in a particular kind of material, by setting up calibration curves covering the entire range of concns. occurring practically. The low-voltage d.-c. arc is used. In Al of 98% or higher purity, the most common impurities, Si, Mg, Cu, Fe, Mn, and Zn, are detd. simultaneously, in concns. from 0.001 to 1%, by selecting the best compromise arc conditions with which to obtain calibration curves. The av. deviation of the results ranged from 3% (Mn) to 12% (Mg). Lime slag, dolomite slag, steel, and white metal were investigated, and semiquant. results were obtained for certain minerals. As a basis for comparison of the sensitive lines of the unknowns in slag, an internal standard was used by adding 9 parts CuO to one part slag. This minimized the percentage variation of each unknown in the sample, and improved handling in the arc. In steel samples, 13 elements ranging from 0.1 to 0.005% in concn. can be detd. to 3-6%. The Mn concn. in C

steel samples was reported about 50% higher by chem. analysis than by spectroscopic detn.; the presence of 0.02% Cr caused the error in the chem. analysis. No satisfactory method has been found for detg. all the elements in clay simultaneously. However, if the clay is dissolved in $\text{HF-H}_2\text{SO}_4$, subsequent spectral analysis reveals, in addn. to the expected Na, K, Ca, and Mg also Si, Al, Fe, Ti, Ba, Sr, V, Pb, B, Mn, and Ni. The residue left after dissolving shows qualitatively Si, Ti, Cr, Al, Fe, Mg, Mn, Ca, Ba, Sr, and B. Investigations are continuing to improve the accuracy, which depends principally on the photographic plate and the reproducibility of the emission conditions.

2673. GILLIS, J., ECKHOUT, J., AND DOORSELAER, M. VAN.

Quantitative Spectrographical Analysis of White Metal by Use of Spark Excitation. *Anal. Chim. Acta*, 1, 209-17 (1947) (in English).

C. A., 42, 4494d (1948).

The possibility is shown for detg. spectrographically the principal components of a white metal, and the max. amts. of impurities that may be present. The method is described in detail and working curves are shown for Sb and Cu, as well as for several impurities, in the tin-base alloy. The method is simple and quick and of rather high accuracy.

2674. GIVORD, J. P.

The Spectrographic Determination of Iron and Silicon in the Aluminum from Electrolytic Tanks.

Congr. groupe avance. method. analy. spectrograph. produits mét., Paris, 8, 63-7 (1947). C. A., 42, 3696c (1948).

A spectrographic method is described designed to replace time-consuming chem. detns. of Fe and Si. A spark between the sample and a counter-electrode of graphite is examd. with a conventional spectrograph. For Al samples contg. 0.05-1% Fe and Si these elements are detd. within about 7% of the truth.

2675. GRIFFING, M., DEVRIES, T., AND MELLON, M. G.

Spectrographic Examination of Organic Precipitates. Nickel Dimethylglyoxime. *Anal. Chem.*, 19, No. 9, 654-5 (1947).

C. A., 41, 6833f (1947).

The sepn. of Ni by pptn. with dimethylglyoxime was studied spectrographically. Al, Cr, Cu, and Mn are copptd., the Cr and Mn so slightly that they cause no error. Al and Cu make the ppt. perceptibly heavy. Sb, As, Ba, Cd, Ca, Mg, K, Na, Sr, and Zn were not copptd. or adsorbed.

2676. GRUSZECKI, P. J.

Setting Up for Spectrographic Analysis.

Iron Age, 159, No. 16, 44-6 (1947).

C. A., 41, 3325i (1947).

The app. described consisted of a standard grating instrument with an approx. dispersion of 7 Å per mm. in the first order, designed for 35-mm. film, adapted for 15 spectra. The densitometer, equipped with a master plate and comparator, employs a motor-driven scanning slit 12 microns wide and 1.1 mm. long. A motor-generator with an automatic voltage regulator was installed with the Multisource unit. This unit is equipped with circuit timers, meters, voltage regulator and an oscillograph to show the pattern of the elec. discharge. Arc or spark excitation is provided. In examn. of specimens, the flat-surface technique was employed. Details of operation of the equipment are given. In a study of analytical results obtained with this instrument, it was found that barometric pressure had a significant effect upon the elemental curves, notably with certain elements such as Mo. When the pressure was 74 cm. or above, the plotted analytical curves remained normal, but below 74 cm., erratic results were obtained. White metal base alloys and Al alloys are being analyzed spectrographically with an accuracy of 5% of the concn. 6 references.

2677. HALD, P. M.

The Flame Photometer for the Measurement of Sodium and Potassium in Biological Materials.

J. Biol. Chem., 167, 499-510 (1947).

C. A., 41, 3150a (1947).

Detns. of Na and K in biol. substances by means of the flame photometer (C. A., 40, 25^a) were compared with detns. made by H.'s chem. procedures (C. A., 40, 4756¹). Biol. materials require preliminary prepn. For K detn.; dil. serum from 1:10 to 1:25 with 0.9% NaCl; dil. urine 1:20 with H_2O ; ash foodstuffs with approx. 1 ml. of 4 NH_4SO_4 /g. of foodstuff, add 1 ml. of concd. HCl for each original g. of foodstuff and dil. 1:50 with H_2O ; treat feces like foodstuffs; dil. whole blood 1:100 with H_2O . For Na detn.: dil. serum 1:250 to 1:500 with H_2O ; dil. urine 1:40 with H_2O ; treat foodstuffs as for K detn. but dil. to 1:25; treat feces the same as foodstuffs but dil. 1:10; ash whole blood with its own vol. of 4 $\text{N H}_2\text{SO}_4$, dil. 1:200 and filter to remove insol. Fe salts. The importance of blank detns. is emphasized. Extensive comparative data are presented tabularly. In accuracy flame photometric detns. compare favorably with those obtained by the best chem. procedures. While analysis can be made far more rapidly by the flame photometer than by any gravimetric or volumetric method, satisfactory operation of the flame photometer depends critically on a very competent technician.

2678. HARVEY, C. E.

Method of Semi-Quantitative Spectrographic Analysis.

Glendale, Calif.: Applied Research Labs.

1947. 285 pp.

Reviewed in *Anal. Chem.*, 20, 494 (1948).

C. A., 42, 4498g (1948).

This book describes a spectrographic method of semiquantitative analysis that requires no large series of prepared standards and provides approximate quantitative analysis for most elements which can be detected spectrographically in the direct current arc source. The last 25 pages are tables of sensitivity factors for five groups: nonferrous, ferrous, alkali, refractory oxides, and rare metal.

2679. HASLER, M. F.

Economic Significance of Direct-reading Spectrochemical Analysis.

Iron Age, 160, No. 7, 71-3 (1947).

C. A., 41, 7293h (1947).

In the operation of a large elec. furnace, it is shown that about 20 min. could be saved in every melt of from 5 to 8 hr. with a direct-reading instrument. One instrument can handle up to 10 furnaces efficiently.

2680. HELZ, A. W. AND SCRIBNER, B. F.

Spectrographic Determination of Minor Elements in Portland Cement.

J. Research Natl. Bur. Standards, 38, 439-47 (1947) (Research Paper No. 1786).

C. A., 41, 5698i (1947).

Rapid, reproducible, and simultaneous spectrographic detns. of Al_2O_3 , Fe_2O_3 , MgO , Na_2O , K_2O , Mn_2O_3 , and TiO_2 are performed on cement powder with an accuracy of 0.1% referred to chem. analysis. Test pellets are prepd. with graphite, a KNO_3 - CoO mixt., and up to 60% cement. An over-damped-condenser discharge serves as a means of excitation.

2681. JASWINSKI, S. T.

Spectrographic Control of the Converter Blow.

Iron Age, 159, No. 22, 50-7 (1947).

C. A., 41, 4422c (1947).

A study was made to det. whether it is possible to correlate the end point with the disappearance of certain spectrum bands in side-blown converter operation and to predict the compn. of the bath and the temp. during a blow by the at. spectrum. The spectrum is particularly intense during the strong boil when C is eliminated by oxidation. Apparently the flame spectrum of Fe appears only under those conditions in which Fe carbide and O are present simultaneously. The presence of the at. spectrum in the converter flame, correlated with thermal and

chem. conditions of the metal bath, is a good indication of the progress of the blow. Appearance of an intermittent green line is proof that at. Fe appears near the mouth of the vessel, although the concn. of the atoms present is not strong enough to give a strong emission spectrum. However, this can be correlated with bath temp., C content, and C elimination.

2682. JAYCOX, E. K.

The Spectrochemical Analysis of Nickel Alloys.

J. Optical Soc. Am., 37, 159-62 (1947).

C. A., 41, 3709f (1947).

A procedure is described for the analysis of Ni alloys for Cu, Fe, Pb, Mg, Mn, Si, Ti, and Zn in the range 0.005-0.30% and for B in the range 0.0003-0.03%. Samples are taken into solution with dilute nitric acid, evaporated to dryness and baked at 400°C. The resulting dry nitrate-oxide powder is mixed with pure carbon dust which acts as a buffer and diluent. Aliquots of each sample and of a series of standards are excited in the direct current arc and their spectra recorded on the same plate. Determinations of the amounts of constituent elements present in the sample are made by measuring the logarithm of the ratio of the relative intensities of a line of the element sought to that of a nickel control line by the general internal control technique.

2683. JAYCOX, E. K.

Spectrochemical Analysis of Ceramic and Other Nonmetallic Materials.

J. Optical Soc. Am., 37, 162-5 (1947).

C. A., 41, 3707c (1947).

The procedure described is applicable to the quant. spectrochem. analysis of ceramic material, ashes, ores, paints, and other non-metallic materials for the detn. of most of the common metals and their oxides. These include: Al, B, Ba, Be, Ca, Cu, Cr, Fe, Li, Mg, Mn, Na, Pb, Si, Ti, Zn, and Zr. Powd. samples are mixed with 10-100 parts of a suitable metal oxide (e.g., CuO) which serves as a buffer, diluent, and for internal control. Carbon dust is added to this mixt. for its addnl. buffering effect. Spectra are obtained of the samples and of an appropriate series of standards. Detns. of the amt. of element sought are made, in most cases by the well-known internal-standard technique, in others by the simple comparison standard procedure.

2684. JENSEN, D. P.

Spectrographic Analysis of Stainless Steels.

Iron Age, 160, No. 3, 47-8 (1947).

C. A., 41, 5816b (1947).

In the spectrographic analysis of stainless steel, the principal difficulty arises from the fact that the matrix element Fe does not maintain the constancy for all alloys of the

family that it does for nonstainless steels. For the 18-8 alloy, satisfactory spectrographic analyses have been obtained, with Fe as the internal standard. Some have tried to span the nonconstancy of the matrix element by introducing a "diln. factor." An unknown sample is not amenable to analysis by this method. A method has been developed in which the internal standard is the sum of all the metallic constituents of the specimen. By using this standard, the complete analysis for such widely different members of the stainless family as types 301, 310, 316, 347, 403, and 446 has been accomplished. Within this group, the max. deviation for individual elements as is as follows: Mn $\pm 6.50\%$, Si $\pm 4.20\%$, Ni $\pm 3.10\%$, Cr $\pm 2.15\%$, Mo $\pm 7.20\%$, Cb $\pm 3.00\%$, Ti $\pm 3.15\%$, Al $\pm 5.00\%$, W $\pm 5.60\%$. Methods of calcn. under this system are discussed. The method is suitable for either d.-c. arc excitation with a platform type electrode or with a.c. spark, point-to-plane excitation (cf. C. A., 41, 33251).

2685. KAISER, H.

The Calculation of Detection Sensitivity.

Spectrochim. Acta, 3, 40-67 (1947).

C. A., 42, 2539h (1948).

The spectrochem. detectability of the elements is limited by the weakening of the analysis lines with decreasing concn. until they are lost in the background. In this work the detection limit is defined as a blackening difference between line and background equal to $3\sqrt{2}$ times the av. blackening fluctuation. The corresponding concn. can be calcd. from extrapolation of an analysis curve covering the range of accurately detd. concns. No samples with low concn. in the region of the detection limit are required. The accuracy of the detn. decreases with diminishing concn. The detn. limit is defined as the concn. at which the dispersion of the results in consequence of the blackening fluctuations reaches 10% of the actual amt. These considerations make it possible to compare quantitatively different light sources, arrangements, and procedures, as regards their detection sensitivity. As an exptl. example the limit of detection of Zn in Al is detd. with the Fuessner spark, with and without inductance, and with the interrupted arc. It is found that the interrupted arc has 50 times greater sensitivity for Zn detection in Al than the Fuessner spark without self-inductance. The possibility of making approx. analyses based on the detection limits of various strong lines of the element to be detd. is discussed.

2686. KENNEDY, W. R.

Spectrochemical Analysis of High Copper in Cast Iron and Steel.

J. Optical Soc. Am., 37, 154-8 (1947).

C. A., 41, 3709c (1947).

A spectrographic procedure with spark excitation is described for analysis of Cu in steel and cast iron. In the range 0.02 to 0.20% the intensity ratio of Cu 3274 and Fe 3264 Å is used, but from 0.20 to 0.80% Fe 3286 Å is adopted as internal standard. A satisfactory method for detg. Cu up to 2.50% or more is found in the use of an a.-c. arc at 5 kv. and with 1.5 amp., and the intensity ratio of Cu 2824 to Fe 2819 Å lines as a function of Cu concn.

2687. KESSLER, K. G. AND WOLFE, R. A.

The Measurement of the Intensity Ratios of Spectral Lines with Electron-multiplier Phototubes.

J. Optical Soc. Am., 37, 133-44 (1947).

C. A., 41, 3693d (1947).

Some properties of electron-multiplier phototubes are investigated. The use of these tubes in quant. spectrographic analysis is discussed, and a scheme for reducing the effect of the dark current is described. A sharply tuned electronic filter passing only the 120-cycle component of the signal is used to increase the signal-to-noise ratio. An amplifier circuit for measuring the intensity ratios of spectral lines is shown, and results from the application of this circuit to the analysis of Cr in steel are tabulated.

2688. KHEĬITS, A. L. AND KATCHENKOV, S. M.

Investigation of the Purity of Platinum.

Bull. acad. sci. U.R.S.S., Sér. phys., 11, 301-2 (1947).

C. A., 42, 1857i (1948).

Pt used for standards was chemically purified and the purity spectrographically analyzed. The final purity of Pt was 99.999%.

2689. KHRSHANOVSKIĬ, S. A.

The SL-5 LOMZ portable steeloscope.

Zavodskaya Lab., 13, 214-16 (1947).

C. A., 42, 2143i (1948).

This app. is 57 cm. long, 28 cm. high, 140 cm. (max.) wide, weighs 3 kg., and has the general aspect of a sub-machine gun. A replaceable rotating disk, which serves as a counter-electrode, is mounted in front of the slit; a second projection close by serves both to steady the instrument against the sample and to supply it with electricity. The optical path is folded by means of reflecting prisms; the refracting-prisms table can be rotated. The instrument's useful wavelength range is 4000-6700 Å; it can resolve lines 1 Å apart at 5400 Å. It performs satisfactorily between -20 and 40°.

2690. KIBISOV, G. I., KNYAZEVA, S. V., AND TARAKANOVA, M. G.

Determination of Chlorine and Bromine with the Steeloscope.

Zavodskaya Lab., 13, 1493-5 (1947).

C. A., 43, 4179h (1949.)

Drip the sample soln. into an a.-c. arc through an opening in a Cu tip used as the lower electrode. The best lines for observations are those near the H lines in the blue region (4861.3 Å); the H line is broad under the conditions used and interferes seriously, as do the lines of N. Nevertheless, the following lines are of value and detns. of fair sensitivity can be attained (about 0.001%). The useful lines in A with % concn. necessary for appearance in parentheses are: Br: 4785.5 (0.001), 4678.7 and 4816.7 (0.01), 4719.8, 4742.7 and 5182.4 (0.05), 5422.8, 5332.0, and 5304.1 (0.1), 4542.9 (0.5), and 4728.2 and 4735.5 (1.0); for 2% and over use 4728.2 and 4735.5. Cl: 4819.4 (0.01), 5078.1, 4917.7, and 4904.7 (0.02), 4781.3 and 4740.4 (0.05), 4572.7 (0.1), 5221.3 (1.0); for over 2% use the latter. The electrode gap should be small (0.3-0.5 mm.). Presence of Fe, Cr, NH₄, and K did not affect the intensity of the lines (within the limits of the instrument used).

2691. KIBISOV, G. I., OVCHINNIKOVA, N. F., AND SVENITSKIĬ, N. S.

The Spectroscopic Determination of Sulfur by Means of the Steeloscope.

Zavodskaya Lab., 13, 186-9 (1947).

C. A., 42, 2544i (1948).

The sample, consisting of about 1 g. of powd. anthracite coal spiked with 1-8% Mo, was spread on a Cu plate, which served as the lower electrode and could be swung so as to bring various portions of the powder under the upper electrode. Samples in soln. were run according to *C. A.*, 39, 833¹. With an activated a.-c. arc for excitation, the intensities of various S, Cu, and Mo lines in the interval 5392-5700 Å were compared. Intensity tables and appropriate spiking concns. are given for 0.001-7.0% S.

2692. KLINKENBERG, P. F. A.

The Spectrum of the Rhenium Atom, Re I. *Physica*, 13, 581-604 (1947) (in English).

C. A., 42, 2174f (1948).

New arc, spark, and hollow-cathode spectrograms have been obtained for Re and an improved sepn. of Re I and Re II spectra was made. Preliminary interferometric studies resolved many hyperfine-structure patterns apart from the 5 resonance lines studied by others. By means of the combination principle the analysis of the Re I spectrum was revised and extended by 10 even and 55 odd energy levels. The no. of newly classified lines is about 700, so that at present 1171 Re I lines are accounted for as transitions between 29 even low levels, 129 middle odd levels, and 14 high even levels. Tables of the known energy levels, and of all classified Re I lines are given. Some difficulties with

the interpretation of the empirical terms are discussed and the need of Zeeman-effect observations is stressed.

2693. KOMAROVSKIĬ, A. G.

Spectral Analysis of Iron-chromium Alloys.

Bull. acad. sci. U.R.S.S., Sér. phys., 11, 276-9 (1947).

C. A., 42, 1845d (1948).

Samples of alloys contg. Cr and sometimes Ni, W, Mo, and V were analyzed chemically and spectroscopically. Three samples of each alloy were made—one without thermal treatment, one with 5-min. heat-treatment at 1100° and hardening in oil and one heated to 900° and allowed to cool slowly. It could be shown that the thermal treatment (structure) had no influence on the detn. of Cr in Fe alloys. The presence of 1.5-4% of Ni, W, Mo, or V did not influence the Cr detn. However, 11-15% Ni and 10-17% W had a marked influence.

2694. KORITSKIĬ, V. G.

Spectral Analysis of Steel.

Bull. acad. sci. U.R.S.S., Sér. phys., 11, 280-75 (1947).

C. A., 42, 1845a (1948).

Cf. *C. A.*, 40, 4976⁷.

The methods of steel spectroscopy by analyzing samples of known compn. were studied by standard methods; modifications were made wherever necessary. For semi-quant. detns. with the steeloscope, Fe-rod and Cu-disk electrodes were used to det. Cr, W, Mn, V, Mo, and Ni. A satisfactory method of analysis could be worked out for all elements with the exception of Ni and Mn. The different homologous pairs are tabulated. In quant. detns. with the spectrograph, the influence of a 3rd element in the alloy and the linearity of the working curves were studied. The influence of electrode materials (Fe, Al, Cu, graphite) on working curves in the analysis with a steelometer was also studied.

2695. KORZH, P. D. AND SHUTMAN, M. N.

Determination of Copper in Steels with the Aid of the Steeloscope.

Zavodskaya Lab., 13, 190-1 (1947).

C. A., 42, 4488i (1948).

A 220-v. d.-c. arc at 3 amp. was used for excitation. The sample acted as anode; the cathode was an Fe rod. After a 2-min. pre-arc, the Cu line at 5105.6 Å (1) was compared with the Fe lines at 5097.0 (2), 5098.7 (3), 5107.5 (4), and 5127.4 Å (5), and the Cu at 5153.2 Å (6) with Fe at 5151.9 Å (7). For Cu = 0.05%, 1 < 2; for 0.10% Cu, 1 ≤ 2; for 0.16% Cu, 1 ≥ 2 and 6 < 7; for 0.22% Cu, 1 ≤ 5 and 6 ≤ 7; for 0.28% Cu, 1 = 5 and 1 < 3; for 0.42% Cu, 1 ≥ 3 and 6 ≥ 7; for 0.50% Cu, 1 > 3 and 1 < 4; for 0.57% Cu,

1 $\leq$ 4 and 1 $>$ 2. Agreement with chem. analysis was excellent.

2696. KORZH, P. D. AND SHTUTMAN, M. N.
Spectroscopic Determination of Sodium in
Fireclay and in Clays.
Zavodskaya Lab., 13, 441-7 (1947).
C. A., 42, 2070e (1948).

In 3- and 5-amp. arcs, 10- and 30-mg. samples of fire clays and clays emitted the Na δ doublet in discontinuous flashes over the whole duration of the evapn. of Na (5-6 min.). Single uninterrupted emission, suitable for quant. detn. is obtained by mixing the material with CaSO $_4$ (1:1 to 1:4); provided the ingredients are mixed intimately, Ca lines will appear only after the Na emission is over; this takes place at the very beginning of the evapn. and its duration τ gives the amt. c of Na, e.g., (10-mg. samples), 0.09, 0.18, 0.23, 0.28%, τ = 12, 18, 23, 29.5 sec.; empirically, $\log \tau$ is proportional to c . The material should be dild. with a Na-free slag or SiO $_2$ to contain 0.1-0.4% Na $_2$ O. Clay should be preliminarily dehydrated at 500° for 15 min. The uncertainty in the detn. of τ causes only an error of $\pm 0.005\%$ in Na. However, detns. on clays with known amts. of NaCl added artificially gave results 0.03-0.05% too low; hence, the strict proportionality of $\log \tau$ and c holds only for the chemically bound Na in clays; addn. of sol. Na salts affects primarily the intensity of the line. In mixts. of sol. Na salts with an open-hearth slag, only the intensity varied markedly with the Na content (0.2-0.5%); τ remained practically const. On the other hand, with mixts. of basic slags (CaO, SiO $_2$, and FeO in varying proportions) with Segar cones (13.8% Na $_2$ O in the form of Na feldspar), the variation of τ with c (0.2-0.6%) was the same as in clays mixed with CaSO $_4$, except that the τ were shorter. The proportionality between $\log \tau$ and c is characteristic of silicate-bound Na. From comparisons of the effects of slags of various compns., it follows that FeO accelerates evapn. of Na in the arc even more strongly than CaO, whereas SiO $_2$ tends to slow it down.

2697. KRÁLIK, F.
Spectral Analysis.
Chem. Zvesti, 1, 230-3 (1947).
C. A., 43, 7857f (1949).
A review.

2698. KRÁLIK, F.
The Spectral Analysis of Brasses by Pfeilsticker's Intermittent Arc.
Chem. Zvesti, 1, 277-94 (1947).
C. A., 43, 8307d (1949).

Pfeilsticker's intermittent arc and Zeiss Q 24 app. give good results in the detn. of Al, Sn, Pb, and Mn. The sparking by the Fuess app. is not satisfactory for detg. traces of Al and Fe. The sparking curves can be ex-

plained by the theory of Mäder-Potzelberger (C. A., 40, 7044¹) and by the dependence on the ionization potentials. The intensity of spectral lines is influenced by the ionization potentials of the alloyed elements and m.p. of the alloys. There is a mutual influence of Cu and Zn on the detn. and calibration of Al and Sn.

2699. KRISTOFFERSEN, K.
Constituents of Basic Slags Falling from the Oxidation Process in a Furnace of the Héroult Type.
Kgl. Norske Videnskab. Selskabs Skrifter, 1947, No. 4, 345 pp. (Pub. 1950).
C. A., 45, 1927b (1952).

Chemical and spectrochemical analyses are reported.

2700. KVALHEIM, A.
Spectrochemical Determination of the Major Constituents of Minerals and Rocks.
J. Optical Soc. Am., 37, 585-92 (1947).
C. A., 41, 5817f (1947).

A method is described for the spectrochem. detn. of Al, Ca, Fe, K, Mg, Mn, Na, and Si in minerals, rocks, slags, and related substances; the detn. of Ti is also discussed. The d.-c. C arc is used. Mix 1 part of powd. sample with 1 part of SrCO $_3$, which serves as internal standard for the detn. of all the elements mentioned except Si, or with 2 parts of quartz and 3 parts of SrCO $_3$ if a more dild. sample is wanted. For the detn. of Si the mixt. is 1 part of sample +1 part of BeCO $_3$ (internal standard) +3 parts of NaCl. Powd. C is added to all the mixts. Three arcings are necessary: for K and Na in the visible and upper ultraviolet region with the sample in the cathode; in the ultraviolet for Si, also with cathode evapn.; another in the ultraviolet for Al, Ca, Mg, Fe, and Mn (and Na) with the sample as anode. The use of different sized electrodes is discussed. Calibration curves are shown based on the spectra of actual minerals, rocks, slags, etc. having reliable chem. analyses. The relative error is in most cases less than 10%.

2701. LEVINTOV, I. I.
Continuous Radiation and Temperature of Ionization of an Impulse Discharge at Atmospheric Pressure.
Bull. acad. sci. U.R.S.S., Sér. phys., 11, 229-38 (1947).
C. A., 42, 1799f (1948).

A condenser discharge is superposed on a steady arc and the radiation of the impulse discharge is sepd. from the general radiation by means of a rotating disk. With Cu as electrode the following cases were studied: (1) ratio of intensities of the arc and spark lines of Cu to the background intensity as a

function of the temp. of the discharge. The study of 13 spark and 6 arc lines of Cu shows qual. agreement with the theory of Unsöld. (2) Ratio of intensities of the arc and spark lines of an impurity to the background intensity with the impurity having a higher or lower ionization energy than the base. The Cu electrodes contain 3% of either Cd, Zn, or Bi. For a lower-ionization-energy impurity 1% Al was alloyed to the Cu. In both cases there is qual. agreement of the results with the theory.

2702. LEVINTOV, I. I.

Spectrographic Determination of Metalloids with the Hot Arc.

Zhur. Tekh. Fiz., 17, 795-802 (1947).

C. A., 46, 1913d (1952).

L. calcs. that the detection limit for a metalloid in the hot arc should be ~1000-fold higher than for a metal (ionization energy ~7-8 e.v.; excitation energy ~3-5 e.v.) in a conventional d.-c. arc. By taking advantage of fractional distn. from a 0.5 g. sample contained in a "boiler" electrode, and by using the total light from the source, L. detected as little as 0.15-0.3% S, Cl, Br, and I in compds. of Cu, K, and Na. For a given Cl/Br concn. ratio, the difference in d. between Cl II 4819 Å and Br II 4819 Å. decreased 8% on changing from a C matrix to a K₂SO₄ matrix.

2703. LINDSEY, A. J., WARD, A. M., AND WILSON, D. W.

Modern Trends in Chemical Analysis.

Chem. Products, 10, 85-90 (1947).

C. A., 42, 3277f (1948).

Recent developments are reviewed briefly in the fields of volumetric analysis, qual. methods, org. reagents for metal ions, gas analysis, quant. electrodeposition, polarography, potentiometric analysis, continuous electro-chem. analysis and control, micro-chem. analysis, and spectrographic analysis.

2704. LOCHET, R.

A New Arrangement for Quantitative Spectral Analysis.

J. phys. radium, 8, 61-4 (1947).

C. A., 42, 461d (1948).

A system is proposed which permits photographing as many as 10 spectra simultaneously. The system involves excitation of electrodes in series and an optical system with a slit divided into segments of equal height. The series of spectra, on a single film, can be read photometrically, and an internal standard used. A complete test of the system was not made, but the following were established: the spark was steady for 20 min.; dispersion is the same for an electrode in series as for one energized singly; for a series of identical electrodes, the spectra are substantially identical, and independent of position. Precision and speed are compared with those for

existing methods, and it is concluded that the new arrangement should be superior in both respects.

2705. LOEUILLE, E.

Chemical Analysis by Emission Spectrography.

Métaux & corrosion, 22, 38-45, 61-7 (1947).

C. A., 42, 1523i (1948).

A review of developments on spectrographic analysis, theory, general description of spectrographs, films, electrodes, samples, and spectrographic analysis of metallurgical products.

2706. LOH, H. Y. AND DIEKE, G. H.

Fluctuations in Gas Discharges.

J. Optical Soc. Am., 37, 837-48 (1947).

Examn. of the light output of discharge tubes, using the multiplier-type photo-tube in conjunction with a cathode-ray oscillograph is suggested as a powerful aid to the usual elec. measurements in understanding the behavior of electric discharges in gases. Exhaustive expts. of this type are under way, the preliminary results of which are reported for air, Ne, A, Kr, Xe, Zn, Cd, Hg, and certain mixts. A striking characteristic of these results is the appearance of oscillations not only in the voltage and current, but particularly in the light intensity. These oscillations appear to be very general, and are not due to the external circuit used. They amount to only a few % in the voltage and current, but often nearly 100% in the light intensity. It seems certain that the theory of elec. discharges should in many cases be revised to take these oscillations into account.

2707. LOKHOV, P. F.

Use of Alternating-current Arc with Magnetic Extinguishing as a Light Source in Spectral Analysis by a Steelometer.

Zavodskaya Lab., 13, 628-30 (1947).

C. A., 42, 4403g (1948).

Accurate results are obtained in analyzing steels for small concns. of Mo, W, Ni, and other elements having weak spectral lines by utilizing as a light source an a.-c. arc with magnetic extinguishing (C. A., 40, 4919*).

2708. LONGOBARDI, E., FLORENTINE, N., AND MBERCADER, A.

Uranium in Petroleum.

Anales asoc. quim. argentina, 35, 131-6 (1947).

C. A., 42, 7959d (1948).

U was found in San Rafael petroleum ash, by radioactivity, chem., and spectral analysis. 7 references.

2709. LOPEZ DE AZCONA, J. M.

A Spectrographic Study of the Elemental Composition of Medicinal Waters of the Spanish Peninsula. I.

Notas y comun. inst. geol. y minero España, No. 17, 3-8 (1947).

C. A., 42, 2039a (1948).

Tables are given showing the approx. concn. of Al, Ba, Be, Co, Cr, Cu, Fe, Ga, Ge, K, Li, Mg, Mn, Mo, Na, Ni, Pb, Si, Sn, Sr, Ti, V, and Zr in 187 water residues. Origins of the samples are shown on a map.

2710. LOPEZ DE AZCONA, J. M. AND CAMUÑAS PUIG, A.

Spectrochemical Analysis of Ash from Asturian Coal.

Anales fís. y quím. (Madrid), 43, 48-50 (1947).

C. A., 41, 3939g (1947).

Varieties of coal can be recognized by kind and proportion of metal elements present. Al is not an element which can be used to differentiate one coal from another, but Ca, Cu, Cr, Fe, Mg, Mn, Na, Si, and V can be so used. Be is very useful, because some coal contains none, others up to 10^{-6} . Co is absent in some coals and present in others up to 10^{-3} . La is very useful, varying widely in concn. up to 1%. Ti varies very widely. Zr was found only in the ash from two Spanish coals. B was not detd., because present in the arc carbons. Five references.

2711. LOPEZ DE AZCONA, J. M. AND CAMUÑAS PUIG, A. C.

Trace Elements in Asturian Coal Ashes.

Bol. inst. geol. minero España, 60, 3-9 (1947) (Separate).

C. A., 42, 3551f (1948).

Cf. C. A., 41, 3939f.

The approx. concns. of 12 trace elements in 50 Asturian coal ashes, observed spectrographically, are tabulated. The av. proportion of the resp. elements is 10^{-x} , where x has the following values: Be 7, Co 3.5, Cu 3, Cr 3, La <2, Mn 4, Ga 4, Ge 6, Sr 3, Ti 4, V 5, Zr 5.

2712. LOPEZ DE AZCONA, J. M. AND JIMENO MARTÍN, L.

The Spark Spectra Between Electrodes Submerged in Water with Direct Current.

Anales fís. y quím. (Madrid), 43, 837-41 (1947).

C. A., 42, 2869b (1948).

The electrodes used were Fe, Pt, Cu, Zn, Pb, Al, Mg, Sn, at 20,000 v.d.c. In the region 3063-3200 Å, bands due to H₂O did not appear in the spectra. This renders difficult a comparison with previous a.-c. spectra.

2713. LUNDGÄRDH, P. H.

The Ultrabasic Gabbro of Roslagen, Central Sweden.

Sveriges Geol. Undersökn., Ser. C, No. 484, *Årsbok*, 41, 1-50 (in English, 43-50) (1947).

C. A., 42, 6283d (1948).

Petrographic study with 10 chem. analyses of rocks, and spectrographic analyses for V, B, Cr, Co, and Ni. Two main periods of intrusion are differentiated by the very low Cr content of the early intrusives (2-6 g./ton), whereas the late intrusives contain 35-220 g./ton. The highest B content was in the olivine gabbros, which contained up to 150 g./ton. The early and late gabbros had approx. the same contents of Co, Ni, and V.

2714. LYUBIMOV, A. P., MANDEL'SHTAM, S. L., FILIMONOV, L. N., AND FOKIN, N. A.

Portable Steelescope.

U.S.S.R. Patent 67,856, Feb. 28, 1947.

C. A., 43, 3249a (1949).

2715. MAL'TSEV, V. F. AND DAVYDOV, A. L. Photoelectric Method for the Simultaneous Determination of Chromium and Manganese in Steel.

Zavodskaya Lab., 13, 926-9 (1947).

C. A., 44, 3399f (1950).

The sensitivity of the spectrophotometer was increased considerably by using an electron multiplier as photo-element. Dissolve 0.1 g. of steel in 8 ml. of 7.2 N H₂SO₄ in a 100-ml. volumetric flask. Add 0.5 ml. of 7 N HNO₃, boil to remove nitrous fumes, add 5 ml. of H₃PO₄, and dil. with 20-25 ml. of hot H₂O. To oxidize Cr and Mn add 5 ml. of 0.25% AgNO₃, 4 ml. of 10% (NH₄)₂S₂O₈, and boil for 0.5 min. Cool, dil. to mark, and mix thoroughly. Fill one cell 15 mm. thick and take a reading at 550 mμ. Take another reading at 450 mμ, with a cell 70 mm. thick. Run a blank on electrolytic Fe. Calc. Cr and Mn from calibration curves. Details are given for constructing the curves.

2716. MARKS, G. W. AND GARDNER, M.

A Chamber for Operating Arcs for Spectrographic Investigations in Controlled Atmospheres.

Rev. Sci. Instr., 18, 370-1 (1947).

A water-cooled brass chamber for operating arcs for spectrographic investigations in atmospheres other than air is described. It is shown that the CN band spectra from 3500 to 4216 Å can be almost completely suppressed when carbon electrodes are burned in an atmosphere of helium and oxygen in the volume ratio 10 to 1. This chamber can be used for arcing metallic electrodes in any non-corrosive atmosphere.

2717. MATHER, K. B.

Spectroscopic Characteristics of Ordinary Acheson Graphite.

J. Proc. Roy. Soc. N. S. Wales, **81**, Pt. 3, 175-9 (1947).

C. A., **43**, 8276b (1949).

This report considers the suitability of ordinary low-grade Acheson graphite for spectrographic electrodes. The characteristics investigated were purity and homogeneity compared with Hilger H. S. brand graphite. Rods of $1/4$ - and $3/4$ -in. diam. were broken to $5/8$ -in. lengths and the broken faces arced at 10 amp. The spectra were photographed (2000 to 5000 Å) with a 1-m. quartz spectrograph. Elements detected in both Acheson and Hilger graphite were Ca, Cu, Ti, V, Al, Si, Mg, Fe, B, which were usually much stronger in the former. The inhomogeneity of Acheson rods was found to be more serious than the impurity. Chem. purification was effected by periodically refluxing the rods with distilled acid (HCl or HNO₃) in a Pyrex extractor. An av. purity of Acheson graphite similar to that of Hilger rods can be obtained for most elements (except B and Si) by acid treatment for 3-4 days but such treated rods are still inhomogeneous and too unreliable for most work. Uniformly reliable rods superior in purity to the Hilger graphite are obtainable with 12-15 days of either HCl or HNO₃ treatment.

2718. MATHER, K. B.

Spectrographic Analysis of Uranium.

J. Proc. Roy. Soc. N. S. Wales, **80**, 187-95 (1947).

C. A., **42**, 5374i (1948).

Spectrograms used to establish the lines were from U acetate on graphite or U oxide on Cu; 124 lines in the region 2500-8000 Å are listed. The cathode layer yielded greater sensitivity than the middle portion of the arc; 10^{-4} mg. of U can be detected in the former and 5×10^{-4} mg. in the arc column.

2719. MCGAVACK, J.

Minor-element Content of Rubber and Rubber Plants.

Rubber Age (N. Y.), **60**, 565-6 (1947).

C. A., **43**, 2799d (1949).

Results, obtained by spectrographic analysis, are given for the Cu, Mn, and Fe contents of the following rubbers: smoked sheet, US-F, *Castilloa*, GR-S, African wilds, kok-saghyz, *Cryptostegia*, goldenrod, milkweed, rabbit brush, guayule, dogbone, *Apolyrum*, spurge, and *Ansonia*. prep'd. in various ways. Where latex methods are used to ext. the rubber, the proportion of minor elements is less than that resulting from mech. methods. In guayule grown without irrigation the Fe content of the roots and upper plant tissue is more than with plants grown under suitable irrigation. Incorporation of $(p\text{-NH}_2\text{C}_6\text{H}_4)_2\text{CH}_2$ in crude rubbers prevents their deterioration and en-

sures maintenance of a const. η and rate of vulcanization.

2720. McNALLY, J. R., JR., HARRISON, G. R., AND ROWE, E.

A Hollow Cathode Source Applicable to Spectrographic Analysis for the Halogens and Gases.

J. Optical Soc. Am., **37**, 93-8 (1947).

Investigations aimed at developing methods of spectrographic quantitative analysis of the halogens and non-metals have been carried out, with emphasis on analysis for fluorine. The relative sensitivities of fluorine spectrum lines in the vacuum ultraviolet region and in the visible region were studied, and it was found that certain visible lines are, at present, more sensitive than the theoretical *ratios ultimes* of fluorine. The greatest absolute sensitivity obtained, using a specially designed hollow cathode source, involved detection of about 0.01 microgram of fluorine, while the greatest concentrational sensitivity was slightly less than one part per million. Chlorine and sulphur were readily detected in amounts as small as 0.20 microgram and 1.0 microgram, respectively, in samples weighing 20 milligrams. Sample handling time was reduced sufficiently to permit routine analyses for these elements.

2721. MEGGERS, W. F.

Principals and Principles of Spectrochemical Analysis.

Spectrochim. Acta, **3**, 5-17 (1947).

C. A., **42**, 2539e (1948).

That spectrochem. analysis has developed into a practical method of vast importance to science and industry is explained by seeking out the principal contributors to spectroscopy and examg. the principles or laws they enunciated. The following general principles of spectroscopy that are directly applicable to spectrochem. analysis are briefly discussed: (1) At. spectra are excited by thermal collisions of atoms or ions, by inelastic collisions with electrons, and by absorption of radiation. (2) Each chem. element is characterized by as many different spectra as the atom has electrons, and the term multiplicities of each are even or odd according as the no. of electrons is odd or even. (3) For practical purposes the wave lengths of at. spectra are invariable. (4) Under specified conditions the relative intensities of lines in a particular spectrum are consts. of nature. (5) Every spectral line is characterized by excitation potentials characteristic of the atoms or ions.

2722. MENYAĬLOW, A. A., DANILOVA, V. V., AND INDICHENKO, L. N.

Chromium and Fluorine in Volcanic Products.

Zapiski, Vserossiiskogo Mineral Obshchestva (Mém. soc. russe minéral.), 76, 139-46 (1947).

C. A., 44, 6787a (1950).

Rocks from the active volcanic centers of N. Kamchatka, especially from Mt. Shivelucha, were examd. spectroanalytically for Cr.

2723. MILBOURN, M.

A Note on the Effect at the Cathode of an Arc Between Copper Electrodes.

Proc. Phys. Soc. (London), 59, 273-5 (1947).

C. A., 42, 1830a (1948).

Observations on burning arcs indicate that melting of a Cu cathode does not necessarily take place, and that selective distn. of impurities occurs when melting is induced by the presence of a metal having powerful reducing properties. Volatilization of Cu from the cathode appears to be effected through the formation of Cu_2O . To obtain information on the volatilization of material, the degree of melting, and the distribution of oxide layers in Cu cathodes, observations were made on burning arcs and on electrodes after they had been subjected to an arc 2 to 3 mm. in length and carrying a current of 5 amp. for 30 to 60 sec., conditions which are typical for analytical purposes. These observations show that melting of the neg. electrode does not necessarily take place during the running of a normal arc between Cu electrodes and, if it does, it can be an extremely localized effect. Selective distn. is likely to occur when the basis metal is molten, but volatilization of Cu is effected through the formation of Cu_2O . These observations have a direct bearing on the spectrographic analysis of Cu and its alloys by an arc technique, but they may also be of value in connection with other types of spectrographic source, which include arc-like phases.

2724. MINGUZZI, C.

Spectrographic Determination of Gold in Italian Pyrites.

Atti soc. toscana sci. nat. (Pisa), Mem. 54, 34 pp. (1947).

C. A., 42, 3696b (1948).

The spectrographic method is discussed and modified. Pb is employed for the extn. of Au, which is thereafter concd. in a Ag globule to be put in the C arc. Cr was chosen as a standard, and, as lines, following couples: 2427.9 Au I-2591.8 Cr I and 2675.9 Au I-2591.8 Cr I. In the study of Italian pyrites it has been found that Au is often concd. on small pyrite crystals rather than on larger ones.

2725. MITCHELL, R. L.

Spectrographic Analysis of Plants and Soils. *Biol. Rev. Cambridge Phil. Soc.*, 22, 1-29 (1947).

C. A., 41, 2520e (1947).

A review with 260 references (cf. C. A., 40, 6191⁹).

2726. MITCHELL, R. L. AND SCOTT, R. O.

Concentration Methods in Spectrographic Analysis. II. Recovery of Trace Constituents in Plant Materials and Soil Extracts by Mixed Organic Reagents.

J. Soc. Chem. Ind., 66, 330-6 (1947).

C. A., 42, 2203g (1948).

(Cf. C. A., 37, 2679⁹.) Take 20 g. of ground, oven-dried plant material and ignite overnight at 450° in an elec. muffle, through which a slight draft of air is drawn. Transfer the ash to a Pt crucible, mix it with 4 g. Na_2CO_3 , and fuse 15 min. Ext. the melt with HCl, evap. on the steam bath and take up the residue in 50 ml. of 4 N HCl. Filter off the SiO_2 and wash with hot water. Cool, add AlCl_3 equiv. to 30 mg. Al_2O_3 , CdCl_2 equiv. to 0.4 mg. Cd and, if necessary, enough FeCl_3 to make the Fe content equiv. to 2-4 mg. Fe_2O_3 . Dil. the soln. to about 150 ml., add 10 ml. of 5% 8-hydroxyquinoline in 2 N AcOH and enough 7.5 N NH_4OH , dropwise to make the soln. just assume an emerald-green color. Follow with 30 ml. of 2 N NH_4OAc and 2 ml. of freshly prepared tannic acid. After stirring, add 2 ml. of freshly prepd. 1% soln. of thionalide in glacial AcOH and 25 ml. of NH_4OH soln., which is equiv. to 2 ml. of AcOH. Stir vigorously, let stand overnight, filter through ashless paper, wash the ppt. with hot water, and ash it at 450° in a porcelain crucible. Transfer this concentrate (30-50 mg.) to glazed paper, weigh, and triturate in an agate mortar. Det. the Fe content colorimetrically (variable internal standard) and det. the trace elements spectrographically by the variable-internal-standard method, using a 1:2 C mixt. in an electrode with a bore of 1.0-mm. diam. Combined spectrographic and chem. errors seldom exceed 10% of the truth. The ranges covered are 2-50 γ for Co, Ni, Mo, Cr, and V and 5-100 γ for the other elements except Zn, where the range is 0.2-4 mg.

2727. MOKRANTS, M.

A Spectrographic Method for the Assay of High-purity Gold Ingots.

Bull. soc. chim. Belgrade, 11, No. 1/2, 45-57 (1940-46) (Pub. 1947) (in Serbian) (French summary).

C. A., 42, 1853e (1948).

A spectrographic method is used in assaying 99.9% Au. It is exact, more rapid than cupellation, and requires only a small sample.

2728. MORITZ, H.

Principles and Present Status in the Development of Spectrochemical Equipment and Methods.

Arch. Metallkunde, 1, 102-8 (1947).

Following an elementary statement of the principles of spectrochemistry, a brief review of equipment and methods mentions new developments in interrupted arcs, controlled sparks, prism spectrographs, and auxiliary apparatus.

2729. MORITZ, H.

Spectrographic Analysis with Solid Electrodes, Especially of Non-ferrous Metals. *Arch. Metallkunde*, 1, 109-14 (1947). *C. A.*, 41, 6487d (1947).

The solid-electrode method is useful, particularly for qual. analysis, because of the simplicity of specimen prepn. and the flexibility of the method. If the specimen is available in form of wire or sheet, it can be used directly. The solid-electrode method is also suited for quant. detns. and the necessary equipment is described. It is best to cast the electrode in a Cu or brass mold; an Fe mold may also be used. For mold materials of lower conductivity external cooling is recommended. The exact procedure for Zn is outlined.

2730. MORITZ, H.

Spectrographic Analysis in Works Laboratories of the Iron and Steel Industry. *Arch. Metallkunde*, 1, 115-21 (1947). *C. A.*, 41, 6169g (1947).

American and German practices are compared. For qual. analyses different procedures are recommended depending on whether single samples or large sample groups are to be analyzed. For quant. analyses limits of detectable percentages for 27 elements are given. In summarizing 50 detns. deviations from 3 to 10% were found in comparison with chem. analyses which is within the required limits.

2731. MORITZ, H.

Spectrographic Semiquantitative Analysis. *Arch. Metallkunde*, 1, 122-3 (1947). *C. A.*, 41, 6169d (1947).

This method is adaptable to solid electrode, powder, and soln. analyses. In a single exposure it yields a survey of the total compn. of the specimen as well as the individual percentages at least in their order of magnitude of the alloying elements, addns., and impurities. Because the evaluation is done by eye it is advisable to have the aperture a little wider than for qual. analyses, care being taken to avoid overlapping of lines. As an example of this method the sepn. of free-machining from Pb-free brass is described. It is also useful to check on impurities, such as Fe, Ni, and Pb, whose upper limits may be limited by specifications. The actual amt. is not detd.; the impurities are compared to neighboring Cu lines having intensities corresponding to

those of the impurity limits. If desired, control electrodes may be taken at the same time, which increases the accuracy and reliability. Another application of this semiquant. analysis was found in the checking of Al-scrap used in the prepn. of light alloys, particularly in regard to impurities but also for the presence of alloying elements. Control specimens have to be used for comparison.

2732. MORITZ, H.

Comments on the Production of Control Specimens for the Spectrographic Analysis of Aluminum Alloys.

Arch. Metallkunde, 1, 124-5 (1947).

C. A., 42, 6702f.

Cf. Werner, *C. A.*, 42, 4093i.

For the application as spectrographic standards, light-metal specimens are prepd. by pressing and drawing castings free from any segregation. It is desirable to provide a set of standards for each alloy type because of inaccuracies introduced by "third" elements not under scrutiny.

2733. MORITZ, H.

Sampling and Specimen Preparation for Quick Determination of Average Compositions of Aluminum Remelts Made with Small Ingots and in Large Melting Furnaces.

Arch. Metallkunde, 1, 125-37 (1947).

C. A., 41, 7340c (1947).

The investigation covered: distribution of the components in the ingots as delivered, sampling method representative of the compn. of the charge, and checking the detns. with large melts. Alloys of the types Al-Cu-Mg and Al-Mg-Si were used. Spectrographic detn. of Cu above 1% is not reliable; the colorimetric method was used for this purpose. Spectrographic analyses carried out by 2 independent labs. indicated that in the upper portion of the ingot Mg is 1.05% and it drops toward the bottom by almost 0.15%. The specified compn. was 1.08%. The opposite was true for Pb which starts with 0.02% at the top and increases to 0.1% at the bottom. The nominal compn. was 0.05%. The results of the chem. method confirmed the spectrographic values closely. No clear correlation with the analysis after remelting the alloys was established. The Cu distribution was found to be in accordance with anticipated segregation owing to gravity. However, specimens taken across a horizontal plane show a drop in Cu toward the center. Therefore, chips taken by cutting through the center of the ingot may give quite misleading results. The remainder of the castings made in the form of electrodes are very useful specimens for the sep. Cu detn. Tests with a very large no. of ingots disclosed such a variation in Mg, Zn, and Pb within the ingots that a

great no. of individual analyses had to be made. Considerable variation was also found between various ingots from the same charge. The av. of 3 to 5 ingots is a close approximation of the av. compn. of the charge. Remelting and careful casting into electrode-shaped molds produced only negligible losses. In order to det. whether or not the spectrographic method is sufficiently consistent for production control, and further to study the variation from the beginning to the end of pouring, electrodes were cast in regular intervals directly from a large melting furnace. The results were in agreement with exptl. work and the method was found suitable.

2734. MORRIS, J.

Spectrographic Analysis of Zinc and Lead.
Can. Chem. Process Inds., 31, 665-6, 669-70 (1947).
C. A., 41, 5815f (1947).

The major items of equipment in the spectroscopic lab. consist of a briquetting press with a 1 in. diam. mold, a multisource power unit which supplies a high-voltage, low-power spark superimposed and in phase with a high-power, low-voltage circuit, a Hilger-Littrow spectrograph with both glass and quartz prisms, and a comparator-densitometer equipped with an electronic voltage regulator. Sampling methods are outlined for the sampling of Zn and Pb bullions. For the former Pb, Cu, and Cd and for the latter Sb, As, Sn, Cu, and Bi are detd. spectrographically. Methods have also been developed for detg. Zn, Pb, and Cu in Cd metal; Pb, Sb, Zn, Mn, Co, Bi, and Al in Sn metal; and Pb, Bi, Sb, and Sn in fine Ag. Results are obtained in a few hours.

2735. MORRIS, V. H., ALEXANDER, T. L., AND PASCOE, E. D.

Composition of the Wheat Kernel.
Milling Production, 12, 10 (1947).
B. A., 22, 1812, abstract no. 18098 (1948).

A study was made of the distribution of ash, protein and inorganic elements in the wheat kernel. A technique for dissecting wheat kernels is described employing a dentist's burr drill. Results showed that ash and protein concns. were highest near the outside of the kernel and lowest near the center, with an increasing gradient toward the outside. Spectrographic elemental analysis of the various fractions showed that P and K are the major constituents in the ash. About 10% of ash consisted of minor constituents including Na, Ca, Mg, Mn, Fe, and Cu. The center of the kernels contained greater percentages of the K, P, and Ca, and lower percentages of Na, Mn, and Cu. Major constituents of the bran were P, Mg, and K.

2736. MUKAI, M.

Spectrophotometric Studies on Gallstones of Inhabitants in the Far East.

Igaku to Seibutsugaku (Med. and Biol.), 10, 327-30 (1947).

C. A., 47, 2341d (1953).

Twenty-three elements, Na, K, Cu, Ag, Mg, Ca, Zn, Sr, B, Al, Si, Ti, Sn, Pb, P, Sb, Br, Cr, W, Mn, Fe, Co, and Ni, were detected spectrophotometrically in gallstones. Gallstones of the bilirubin series contained more inorg. substances and more diverse kinds of elements than those of the cholesterol series. Most of them contained a no. of inorg. elements as main constituents (Ca., Mg, Cu, Mn, Al, and Si) in a definite ratio.

2737. MUKHERJEA, B.

The Purification of Carbon Rods for Spectrographic Analysis by the Cathode Layer Arc.

Indian J. Phys., 21, 119-28 (1947).

Spectrochim. Acta, 3, 631 (1949).

Methods for the purification of carbon rods for spectrographic analysis are reviewed in detail. The two general methods of chemical followed by thermal treatment and electrical resistance heating purification were investigated. For the chemical method, 6.5-cm. by 7.5-mm. "Kino-Homogen" carbon rods were treated successively with HCl plus HNO₃, water, H₂SO₄, water, glacial acetic acid, water, ammonia, and water. After drying, the rods were first heated in an oxyacetylene flame, and then arced in various atmospheres, N₂ bubbled through CCl₄ proving the most successful. The cathode layer technique with 220-v./11 Å d.-c. current and 8-mm. electrode separation, showed the presence in the purified electrodes of B and Si, and traces of Mg, Ti, Al, Ca, Cu, and Fe. The electrical resistance heating method with 9.5 cm. chemically purified rods held horizontally in copper holders and a current of 550 Å/24 v., reduced the amounts of impurities, the Si, Mg, Ti, Al, Ca, and Fe being almost entirely removed.

2738. MUKHERJEA, B. AND SARKAR, P. B.

Spectrographic Determination of Gallium in Indian Bauxite by the Cathode layer arc.

Science and Culture, 12, 598 (1947).

C. A., 42, 4489e (1948).

Cf. Goldschmidt and Peters, *C. A.*, 26, 1548.

The Carc cathode layer technique of Mannkopff and Peters (*C. A.*, 25, 5110) has been used for the quant. estn. of Ga in 9 samples of Indian bauxite. Standard samples were prepd. by using varying concns. of Ga in Ga-free Al(OH)₃. Spectra were recorded on a large Hilger quartz spectrograph by using a

Twyman-Simeon lens arrangement. The Ga line 2943.7 Å was used. Background corrections were by subtracting the blackening of the adjacent area of the Ga line from the blackening of the Ga line. A calibration curve was drawn by plotting these corrected blackening values of the Ga line against Ga concn. The range worked in was from 0.0005 to 0.05% Ga.

2739. MÜLLER-URI, G.

Spectrographic Determination of Calcium in Magnesium Alloys.

Arch. Metallkunde, 1, 137-8 (1947).

C. A., 41, 7300d (1948).

A glass spectrograph was used, as the Ca lines are in the visible range. Filters of 10% to 30% permeability were used to reduce the line intensity; at the same time interference from surface contamination, such as dust, is reduced considerably. The 3895.7 Å Mg line is quite prominent and was compared with the 3933.7 Å line for Ca. Contents of 0.003 to 1.2% Ca could be detd. by this method. A method for Ca detn. with the quartz spectrograph was also developed although with less accurate results.

2740. MÜLLER-URI, G.

Quantitative Spectrum Analyses of Thin-walled Light Metal Specimens.

Arch. Metallkunde, 1, 138-9 (1947).

C. A., 42, 6702e (1948).

It was possible to analyze specimens over 1/8 in. in thickness by mounting small disks on an auxiliary electrode. This is done by means of a blind end hole in the specimen and a knurled shank on the auxiliary electrode. For still thinner specimens it was necessary to draw small cups; in some cases sectors had to be cut out to permit this drawing operation and avoid folding. These cups were then crimped on the auxiliary electrode. In either case it was possible properly to prep. the specimens by light grinding, etching, or polishing.

2741. MYERS, A. T. AND BRUNSTETTER, B. C.

Magnetic Rotation of the Direct-current Arc in Spectrographic Analysis.

Anal. Chem., 19, 71 (1947).

C. A., 41, 1945i (1947).

An improvement in reproducibility can be attained by magnetically rotating the d.-c. arc. This is achieved by rotating a strong permanent horseshoe magnet about its longitudinal axis at 600 rpm. The magnet is placed 2-2.5 in. away from the center of the arc.

2742. MYERS, A. T., DYAL, S., AND BORLAND, J. W.

The Flame Photometer in Soil and Plant Analysis.

Soil Sci. Soc. Am., Proc., 12, 127-30 (1947) (Pub. 1948).

C. A., 43, 1130f (1949).

The flame photometer can be employed directly for the detn. of K in the ammonium acetate leachates of soils. The destruction of the org. matter is not necessary. The av. amts. of Ca and Mg should be included in the standards used to calibrate the instrument. One standard contg. both Na and K ions will give good results. Good reproducibility is possible and the time of detn. of K and Na is within the range of the rapid soil tests. Precautions necessary for accurate work are presented.

2743. NIKITINA, E. I.

Spectrographic Determination of Arsenic in Steel.

Zavodskaya Lab., 13, 885 (1947).

C. A., 42, 8699g (1948).

The method was developed to det. As in steel made from iron ores contg. As. A large autocollimation spectrograph of the Hilger type was used. Source of excitation was an a.-c. arc. The most satisfactory line for analysis, based on intensity and distribution, is the line As I 2349.84 Å which is sufficiently sensitive to As concns. encountered (0.085, 0.13, and 0.36%). The neighboring line Fe I 2350.39 Å was used for comparison. The lines were photometered by method of photometric interpolation. A pointed C rod was used as the 2nd electrode; the use of Cu and Fe rods as const. electrodes gave less satisfactory results. Width of slit in spectrograph was 0.02 mm., distance between electrodes was 2 mm., current strength was 10 amp., and exposure time was 1 min. A medium-type model spectrograph can also be used for these analyses.

2744. NOVOCHATSKIĬ, I. P. AND KALININ, S. K.

The Occurrence of Thallium in Silicates of the Earth's Crust.

Doklady Akad. Nauk S.S.S.R., 56, 831-3 (1947).

Chem. Zentr. (Russian Zone Ed.), 1948, II, 282-3.

C. A., 44, 8294c (1950).

No method is available for the detn. of Tl which is sufficiently sensitive. The best results were obtained with the spectrographic method using the Volta arc between Cu electrodes. The lines 3775.7, 3529.43, and 3519.24 Å were used for the detn. The first of these lines is most sensitive and permits the detn. of 0.001% Tl. Tl was found only in K-Na feldspars, in mica, and rarely in some other silicates, in which K can be re-

placed by Tl since the at. radius of K is 1.33 and that of Tl 1.49 Å. The Tl content was usually 0.001–0.003%. The max. of 0.02% was found in damourite. A list of 20 minerals is given in which no Tl was found by the above method.

2745. O'CONNOR, R. T., HEINZELMAN, D. C., AND JEFFERSON, M. E.

Preparation of Ash and Spectrochemical Determination of Traces of Metallic Elements in Oils, Fats, and Related Substances.

J. Am. Oil Chemists' Soc., 24, 185–9 (1947).

C. A., 41, 4935d (1947).

A modification of the $Mg(NO_3)_2$ method used for ashing org. samples was found satisfactory but time-consuming. Preliminary tests were made of the precision by the use of the method; and where the concn. of the metal in the oil is so low as to require densitometric measurements, an overall precision of $\pm 7\%$ can be obtained. The spectrograph employed must have sufficient dispersion to sep. the important spectrum lines in the most commonly used ultraviolet region from 2500 to 3500 Å. A d.-c. arc operating at 235 v. and 20 amp. was used and the electrode holders were water-cooled. Eastman spectrum-analysis No. 1 plates are satisfactory for photographing the above spectral region. Recovery tests have indicated that the accuracy of the method is within the variations encountered in successive detns. of a metal in the same sample of oil. Approx. limits of the sensitivity of the method for 2.5 g. samples of oil for the detn. of 7 metals: Al, Cu, Fe, Mn, Ni, Sn, Zn show, in general, that the method permits the detn. of these elements when present in only a few parts per million. 20 references.

2746. OERTEL, A. C.

A Note on Background Correction in Spectrochemical Analysis.

Australia, J. Council Sci. Ind. Research, 20, 157–61 (1947).

C. A., 41, 6833e (1947).

The d. log relative exposure curves, as obtained with a rotating-stepped-sector wedge and a Process plate, have the same general shape and the same γ for monochromatic (line) radiation and continuous radiation (at the same wave length) at least up to a d. of 0.85. However, the curve for line plus background has a different shape and γ at high ds. from those of the curve for line alone. It is suggested that the differences are caused by a distortion of the relative exposure scale, owing to the fact that the background radiation is photographically effective only in the steps of large aperture. A method of approx. correction is given.

2747. OERTEL, A. C. AND STACE, H. C. T.

A Spectrochemical Survey of Some Phosphate Rocks and Superphosphates. I. Qualitative.

J. Council Sci. Ind. Research, 20, 110–13 (1947).

C. A., 41, 6470d (1947).

Fifteen samples of phosphate rock and 10 of superphosphate were examd. spectrochemically for 23 elements in addn. to the major constituents (Ca and P), the max. no. of minor constituents being 20 in any one sample. Mo was found in phosphate rock from Egypt, Algeria, and Florida, but not in samples from Nauru and Ocean Island; as supplies from the latter sources were cut off during the war, wartime superphosphate contained more Mo than prewar. Ni occurred in all samples except those from Ocean Island and Nauru. Co was found only in samples from Florida, low-grade rocks from South Australia, and 2 superphosphates. Conclusion: The presence of some of these trace elements, especially Zn and Mo, should be considered in interpreting field expts. carried out with wartime superphosphates.

2748. OFTEDAL, I.

Lead-antimony Sulfide from Reppen in Bindalen [Norway].

Norsk Geol. Tids., 26, 223–4 (1947).

C. A., 41, 6171i (1947).

Chem. and spectrographic analysis of the mineral yielded: Pb 41.7; Sb 35.1; Fe a few %. The mineral is probably jamesonite.

2749. OFTEDAL, I.

Chrysoberyl from Lindstøl in Søndeled [Norway].

Norsk Geol. Tids., 26, 224–5 (1947).

C. A., 41, 6173d (1947).

The occurrence of chrysoberyl in Norway (in Lindstøl and in Nateland) is discussed. Spectrochem. analysis gave for Nateland and Lindstøl, resp.: Fe 5, >5; Mg 0.3, 1; Mn 0.03, 0.1; Ti 0.6, 0.3; Sn 0.1, 0.1; the values are approx. Mg and Mn characterize the chrysoberyl from Lindstøl, and Ti that from Nateland.

2750. OLDFIELD, J. H.

The Direct Reading of Spectral Line Intensities.

J. Iron Steel Inst. (London), 156, 78–80 (1947).

C. A., 42, 54h (1948).

A review of some recent applications to spectrographic analysis. 6 references.

2751. OPLINGER, G.

Spectrochemical Determination of Lithium, Sodium, and Iron in Lithium-bearing Ores.

Anal. Chem., 19, 444-7 (1947).

C. A., 41, 5413a (1947).

The spectrochem. analyses of Li-bearing ores obtained with a 2200-v. arc were within $\pm 1-2\%$ of the actual Li_2O content. Fuse the sample with K_2CO_3 ; ext. the cooled melt in a mixt. of water, H_2SO_4 , and HCl . Add NH_4 molybdate as an internal standard and make up the soln. to a definite vol. Transfer 0.05 ml of soln. to the ends of a pair of C electrodes. After drying and preburning for 20 sec., record the spectrogram obtained with a grating spectrograph calibrated by the two-step sector method of Churchill (cf. *C. A.*, 39, 880'). The log of the intensity ratio of the unknown and the Mo then gives the percentage of unknown through the working curves. Standard samples were prepd. from K_2CO_3 , powd. SiO_2 , AlCl_3 , CaO , MgO , Li_2CO_3 , NaCl , Fe wire, and $(\text{NH}_4)_2\text{MoO}_4$.

2752. ORSAG, J.

Instantaneous Spectroscopy.

Congr. groupe avance. méthod. anal. spectrograph. produits mét., 8th Congr., Paris, 37-8 (1947).

C. A., 42, 3224f (1948).

A photoelec. spectrograph using an electron-multiplier phototube, an electronic amplifier, and a recording potentiometer is capable of scanning an entire spectrum (2000-8000 Å) in a very short time, probably less than 2 sec.

2753. ORSAG, J.

Instantaneous Spectrography.

Congr. groupe. avance. méthod. anal. spectrograph. produits mét. 7th Congr. Paris, 1947, 57-9.

C. A., 42, 828e (1948).

The methods of rapid spectrochem. analysis used in O.'s lab. are discussed with especial reference to the attempts to eliminate the use of photographic recording of the spectra. The principles of a visual photometer are described, and the possibilities of the direct measurement of the intensity of a spectrum line by means of a reflex spectrograph are discussed. The rapid methods of spectrochem. analysis by direct registration in the ultraviolet range by means of a monochromator or a spectrograph and a Zworykin or Gorlich cell are considered.

2754. OVCHINNIKOV, L. N.

Qualitative Spectroscopic Detection of Cobalt and Nickel by Spectrogram Background Radiation.

Zhur. Anal. Khim., 2, 225-8 (1947).

C. A., 43, 6938e (1949).

This method consists of measuring the degree of darkening of the area adjacent to certain lines rather than of the lines themselves. The lines chosen for Co were 3405.12

Å as main line and 3453.51 and 3044.00 Å as auxiliary lines. The line for Ni was 3414.77 Å. On each plate along with the analyzed sample were photographed the spectra of 3-4 standards. The latter were ores of the same total compn. but their Co or Ni content differed in multiples of 3. By this method 600 ore samples were analyzed and the results analyzed statistically. For the 400 Co samples the probable error was $\pm 8\%$ and for the 200 Ni samples it was $\pm 9\%$. This error could be further reduced by using better plates.

2755. OVERMAN, R. R. AND DAVIS, A. K.

The Application of Flame Photometry to Sodium and Potassium Determinations in Biological Fluids.

J. Biol. Chem., 168, 641-9 (1947).

C. A., 41, 6595c (1947).

By the use of the Perkin-Elmer flame photometer model 18, Na and K can be detd. in blood, plasma, red blood cells, and urine with approx. the same accuracy as by chem. methods.

2756. PEARSE, R. W. B.

Spectroscopic Observations on Comets, Meteors, and Meteorites.

Repts. on Progress in Physics, 11, 410-14 (1946-47).

2756a. PEARSON, T. G.

Recent Progress in the Routine Analysis of Aluminum and Its Alloys.

Proc. XIIth Intern. Congr. Pure Appl. Chem., London, 5, 831-49 (1947) (Pub. 1953).

C. A., 47, 7369b (1953).

This critical review includes spectrographic methods. Of the 374 references, 196 are spectrographic.

2757. PERIN, J.

Spectrographic Analysis of Wines.

Journée vinicole, 21, No. 5886, 1, 4 (1947).

C. A., 42, 8411h (1948).

A discussion concerning the effectiveness of spectral analyses.

2758. PETERSON, M. J., KAUFFMAN, A. J., JR., AND JAFFE, H. W.

The Spectroscope in Determinative Mineralogy.

Am. Mineral., 32, 322-35 (1947).

C. A., 41, 4684f (1947).

The usefulness of the spectroscope in detg. the compn. of minerals and other inorg. materials is discussed. The arrangement and operation of the app. are given, with lists of lines suitable for the identification of many elements.

2759. PHÉLINE, J. M.

Method of Determining Silica in Tungsten Trioxide with the Spectroscope. Preliminary Report.

Congr. groupe. avance. méthod. anal. spectrograph. produits mét. 7th Congr., Paris, 1947, 51-6.

C. A., 42, 840i (1948).

The details of spectrochem. detn. of small quantities of SiO_2 present as impurities in WO_3 are discussed, including the prepn. of the samples of WO_3 with varying content of SiO_2 , and the spectrographic technique (220-v., 2-amp. continuous arc; graphite anode, Cu cathode; sample in the anode; ultraviolet spectrum lines used). The presence of F in the samples makes the chem. detn. of SiO_2 difficult, which is not true of the spectrochem. detn.

2760. PHÉLINE, J. M. AND CASTRO, R.

The [Spectrographic] Determination of Small Amounts of Copper in Steels.

Congr. groupe avance. méthod. anal. spectrograph. produits mét., Paris, 8, 47-59, 177-87 (1947).

C. A., 42, 4488g (1948).

Cu is detd. by 3 methods. (1) A few drops of a Cu soln. is evapd. on the ends of both electrodes of a C arc which is examd. on the spectrograph. Standard solns. of Cu are measured and the ratio of photographic ds. of the 3274 Å line of Cu and the 3306 Å line of Fe is compared. The method is also applicable to Ni and Cr. (2) Cu is detd. photometrically by its gray-green color with dithiooxamide, by using several makes of photometers with red filters. The color is stabilized by the addn. of a 0.5% soln. of gelatin, and conforms to Beer's law, at least up to 0.1% Cu. Dithiooxamide can be prepd. by the following method: Add NH_4OH to CuSO_4 soln. until the ppt. just dissolves. Introduce concd. KCN soln. dropwise until the color just disappears. Filter and sat. the filtrate with H_2S . The crystals which sep. on cooling can be recrystd. from alc. (3) Cu is also detd. directly in massive samples or sheets by the spark method with a counter-electrode of Al. Intercomparisons of these three methods indicate that Cu can be detd. spectrographically over the range 0.01-0.1% with an error of 10%.

2761. PHILLIPS, D. F.

Applications of Metallurgical Microchemistry to the Light-alloy Industry. II. Special and Investigational Analysis. *Metallurgia*, 35, 169-71 (1947).

C. A., 41, 2653i (1947).

The equipment used in a microchemical lab. for spectrographic, photometric, and polarographic methods of analysis is described. The polarographic detn. of Zn in Al alloys can be successfully performed on a 5-mg. sam-

ple. Other useful techniques in the analytical field, such as chromatography, electrophoresis, internal electrolysis, the Hg cathode and potentiometric titrations are all readily adaptable to the micro scale. 3 references. (Cf. C. A., 41, 1976b.)

2762. POTTER, E. V. AND SCOTT, A.

An Automatic Arc-current Regulator.

Rev. Sci. Instruments, 18, 722-6 (1947).

C. A., 42, 2144b (1948).

The effect of current variations in carbon-arc spectroscopy is discussed. An arc-current regulator is described. Spectrographic analyses agree much better with chem. analyses for the regulated than for the uncontrolled or manually controlled arc.

2763. POUVREAU, J. M.

The Influence of the Microstructure of the Electrodes Upon the Accuracy of the Spectrographic Analyses of the Alloys Aluminum - copper - magnesium - silicon (AU 4 G).

Congr. groupe. avance. méthod. anal. spectrograph. produits mét., 7th Congr., Paris, 1947, 61-3.

C. A., 42, 1149i (1948).

The studies were made on an alloy with the compn. 4% Cu, 0.75% Mg, 0.50% Mn, 0.40% Si, 0.35% Fe. From each sample 40 separate spectra were taken under identical conditions. The av. variation was calcd. from the Gauss formula. The values for small and homogeneous grain (quickly cooled, physically treated, tempered) are: Mg 4.56%, Mn 4.57%, Si 4.85%, Fe 3.42%. The corresponding values for coarse grain, obtained by heating the sample to 850° and very slowly cooling, were: 11.20, 8.40, 10.10, and 9.55.

2764. PRILEZHAeva, N. A., RUBTSOVA, N. K., AND SYCHEV, V. P.

Concentration and Distribution of Electrode Material in the Arc and the Spark Discharge.

Bull. acad. sci. U.R.S.S., Sér. phys., 11, 239-45 (1947).

C. A., 42, 1799h (1948).

The radiation emitted in an arc discharge between Cu electrodes was absorbed in an arc or a spark discharge between Cu or Ag-Cu (16%) electrodes. The ratios of the duration of excited states τ_{5218}/τ_{5105} and τ_{5153}/τ_{5105} were found to be in good agreement with previously published results. The distribution of Na in a C arc and of Al or Ag in a Cu arc show that, along with diffusion, field action of pos. ions is very considerable. In a spark discharge the distribution depends on diffusion.

2765. PROKOF'EV, V. K.

Mechanism of Evaporation of the Electrode Material in Spectroanalytic Light Sources.

Bull. acad. sci. U.R.S.S., Sér. phys., 11, 289-97 (1947).

C. A., 42, 1843b (1948).

Changes in the abs. intensities of Cu lines in alloys of Cu with Al, Sn, and Zn were studied. The second electrode was made of Cu, Al, or graphite. The intensity of all Cu lines in the arc discharge is increased with increased content of alloying metal. Graphite electrodes decrease but Al electrodes increase the intensity as compared to a 2nd Cu electrode. The reverse is true in a spark discharge. This is attributed to a change of the temp. in the discharge. Therefore, the slope of the working curve is given by the change of intensity of the line of the alloying element in function of its concn. and by the change in intensity of the Cu lines owing to the influence of the 2nd element. P. also studied the intensity of lines during alternating cycles in the a.-c. arc. He found that Pb, Fe, Sn, and Si lines were brighter when the sample was pos. but Al, Ni, and Zn lines were brighter when the sample electrode was neg. The nature of the surface layer formed on Al-Si electrodes with 12% Si in a condensed spark discharge was also studied. This layer without sp. structure has an increased hardness and seems to be composed of Si.

2766. PROKOF'EV, V. K.

The G. O. I. Quartz Spectrograph.
Zavodskaya Lab., 13, 175-81 (1947).

C. A., 42, 2520e (1948).

This instrument uses a spherical collimating mirror ($f = 600$ mm.), a 60° Cornu prism (base = 47 mm.), and a two-element quartz objective. The photographic plate is 9×24 cm.; it makes an angle of $41^\circ 40'$ with the optic axis, and is kept flat. The resolving power of the instrument is 10^4 ; its relative aperture in the near ultraviolet is $\sim 1:21$.

2767. RENDIG, V. V.

Rapid Determination of the Base-exchange Capacity of Soils with the Flame Photometer.

Soil Sci. Soc. Am., Proc., 12, 449-51 (1947).
C. A., 43, 2721g (1949).

The soil is first base-satd. with neutral KOAc soln. and the excess salt is removed by washing with water and alc. The exchangeable K is extd. with a soln. of ammonium and Mg acetates and the amt. of K in the ext. is detd. with the flame photometer. In general, the results are slightly higher than those obtained by the NH_4OAc method and somewhat lower than by the $\text{Ca}(\text{OAc})_2$ method.

2768. RICCIBONI, L., ZOTTA, M., AND FOFFANI, A.

Spectrographic Analysis of Refined Lead.
Gazz. chim. ital., 77, 153-81 (1947).
C. A., 41, 7302f (1947).

A new app. and operating technique, involving excitation by the spark method and rotating interruptor with single discharge of high frequency for each semiperiod, are described and illustrated, with complete operative details. This assembly was developed with a view to analyzing Pb for Cd, Cu, Ag, Bi, Sn, Sb, and As. These elements were added to Pb of known purity (deoxidized in a high vacuum to 99.996% purity). On the basis of curves of blackening corresponding to the various spectral positions and obtained with a rotating graduated sector, the best conditions for detg. these elements were established. By accepting for the particular exptl. conditions a limit of blackening of S 0.3 and extrapolating on the diagrams, the following limiting values in atom percentage and wt.-percentage, resp., were found for each element in the particular sample of Pb analyzed: Cd 0.001, 0.0006; Cu 0.001, 0.0003; Ag 0.0009, 0.0005; Bi 0.0015, 0.0015; Sn 0.002, 0.0012; Sb 0.007, 0.004; As 0.01, 0.004. The error is of the order of 3-8%. It is thus possible to analyze Pb of a purity at least up to 99.988% for metal impurities.

2769. ROACH, F. E. AND ROLLINS, T. J.

Self-Reversal of Spectral Lines in Al-Mg Alloys.

J. Opt. Soc. Am., 37, 989 (1947) (an abstract).

In a recent paper J. Van Calker has suggested the utilization of the weakening of spectral lines by self-reversal in spectrochemical analysis. Since the weakening of a given line in general increases with the amount of the element present in the sample, empirical curves can be drawn relating line attenuation with composition. As internal standard it is possible to use a line due to the element under analysis which is relatively insensitive to weakening from self-reversal. This, in a sense, is a method of "absolute" analysis, since both the variable and the internal standard lines are due to the same element. Measurements have been made of the relative intensities of a number of magnesium lines from samples of Al-Mg alloys in which the magnesium content varies from 0.008 per cent to 10 per cent. Working curves have been made for typical experimental conditions. The results have been examined with regard to their use in spectrochemical analysis and also have been interpreted in the light of the studies of G. H. Dieke and H. M. Crosswhite.

2770. ROGERS, L. H.

Report on [the Determination of] Zinc in Soils.

J. Assoc. Offic. Agr. Chemists, 30, 310 (1947).

C. A., 41, 7034h (1947).

In R.'s lab. a combination dithizone-spectrographic method is used. The extd.

soil soln. is evapd. to dryness, org. matter is destroyed with H_2O_2 , the residue is taken up in dil. HCl, the pH is adjusted to 8.5, and the soln. extd. with several portions of dithizone in CCl_4 . The combined CCl_4 exts. are evapd. to dryness and taken up in a min. of $CHCl_3$; an internal standard soln. is added, and aliquots are dried on graphite electrodes. These are then analyzed spectrographically by using conventional plate calibration and intensity ratio procedures.

2771. ROGER, L. H.

Determination of Exchangeable Bases with the Air-acetylene Flame and Quartz Photoelectric Spectrophotometer.

Soil Sci. Soc. Am., Proc., 12, 124-6 (1947).
C. A., 43, 1130g (1949).

A modified Lundegårdh air-acetylene flame burner has been used successfully with a Beckman quartz spectrophotometer to det. exchangeable Ca and K in sandy soils. On a routine basis, detns. can be made at the rate of about 1 min. per element per sample. The same soln. can be used for the detn. of both elements. On 10 sep. measurements on a single soln. the av. deviation of a single measurement was 2.9% for K and 3.4% for Ca. Several other elements can be readily detd. by the procedure but the total no. of elements that can be measured with the flame photometer procedure appears to be fewer than 10.

2772. ROSE, H.

Trace Elements in Rocks of the Harz and of the Saxon Erz Gebirge.

Fortschr. Mineral., 26, 108-15 (1947).
C. A., 44, 9312i (1950).

Improvements are described in the method of subliming volatile elements under high vacuum and detg. them spectrographically (cf. C. A., 29, 5773^r and Ottemann, C. A., 35, 3196^s). Examn. of several granites showed the presence of Sn, most of which was not present as cassiterite. Analyses for Sn, In, Tl, Pb, and Zn are given for 17 minerals and 2 rocks. The highest Sn content was in wolframite (1%). The Sn content of silicate minerals was highest in those contg. much F, especially biotite and tourmaline. Evidence of substitution of Pb for Ca was noted in epidote and plagioclase.

2773. ROZSA, J. T.

Slag Control by Routine Spectrographic Analysis.

Metal Progress, 51, 593-7 (1947).
C. A., 41, 3391b (1947).

Methods are described for the chem. analysis in 11-18 min. of slags from open-hearth and elec. furnaces obtained in the production of steel. Ca, Mg, Mn, Si, Al, P, Cr, Ti, Ni,

and Fe can be detd. This permits accurate control of the final compn. of the steel.

2774. RUSANOV, A. K.

Evaporation of the Elements in a Carbon Arc and the Stabilization of the Flame Temperature in the Arc.

Bull. acad. sci. U.R.S.S., Sér. phys., 11, 303-9 (1947).

C. A., 42, 1843g (1948).

Cf. C. A., 40, 5344^s.

The evapn. of Au, Ag, Pb out of channels in graphite anodes was studied. These elements do not wet graphite. The main factors influencing the amt. of evapd. material are the evapn. velocity and the size of the surface of the melt. The depth of the channel is of importance because of the temp. gradient in the anode. The change in intensity of the Cu line 2824.4 Å is shown to be parallel to the change in the rate of evapn. In the case of elements wetting graphite or forming carbides the conditions are more complicated. It is recommended to mix the sample with graphite 1:1 and to evap. them in a channel of 1-2 mm. diam. and 10-15 mm. deep. Introduction of a wick contg. Na_2CO_3 is useful.

2775. SCHUENECHT, W.

Quantitative Spectrochemical Analysis in the Industrial Laboratory.

Optik, 2, 81-98 (1947).

C. A., 43, 2114e (1949).

Spectrochim. Acta, 3, 260-1 (1948).

A review.

2776. SCRIBNER, B. F. AND MEGGERS, W. F.

Index to the Literature on Spectrochemical Analysis. Pt. 2. 1940-1945.

Am. Soc. Testing Materials (1947), 180 pp.
C. A., 41, 4740b (1947).

A bibliography of about 1050 references and abstracts of publications in spectrochemical analysis, arranged chronologically by years, 1940 to 1945, and by author in each year. A detailed subject index is included. Reviewed in *Spectrochim. Acta*, 3, 119 (1947).

2777. SEMENOVA, O. P.

Temperature and Absolute Intensity of Spectral Lines in a Low-Pressure Arc.

Bull. acad. sci. U.R.S.S., Sér. phys., 11, 246-51 (1947).

C. A., 42, 1817e (1948).

A study of the intensities of Cu lines 5105 and 5135 Å in a C arc discharge burning in a container in which the air pressure can be varied shows that the effective temp. of the arc decreases from atm. pressure to approx. 270 mm., from which it increases again owing to an increased ionization by higher-energy electrons. The intensity of the Cu lines has a first max. at about 450 mm., a min. at 270

mm., and a second sharp max. around 180 mm., from which the intensity drops owing to a decrease of Cu atoms in the discharge. Action of collisions of the second kind was studied on Cu lines in a Cd-vapor discharge.

2778. SERGEEV, E. A.

A Method for Exciting Spectra in the Arc, with the Superposition of a Magnetic Field.

Zavodskaya Lab., 13, 231-3 (1947).

C. A., 42, 2873c (1948).

A pair of C electrodes is placed with axes horizontal about 0.5 mm. above the surface of a powd. rock sample. An electromagnet with d.-c. excitation is situated so that its core is 15-20 mm. above the axis of the arc. As the sample melts, and its vapor is swept up into the arc, the sample tray is moved about under the arc. The spectra are comparatively free of background; sensitivities of 0.001% for Sn and W, and 0.01% for As have been obtained in rock powders.

2779. SERRA, A.

Spectroscopic Study of Colored Mineral Fluorine Compounds.

Ricerca sci. e ricostituz., 17, 670-1 (1947).

C. A., 43, 7381b (1949).

Relative qual. data tabulated for Al, Ba, Ce, Co, Fe, Mg, Mn, and Sr are obtained by the condensed-spark method with solns. resulting from the decompn. of the mineral with concd. H_2SO_4 , and by the cored-cathode powder method. These data indicate that the violet and sometimes rose or blue color of certain Italian, French, and Derbyshire fluorites is due to the presence of Mn; and the green color of certain Swiss, Italian, and French fluorites to Fe. These conclusions are supported by microchem. analyses.

2780. SHIRLEY, H. T., ELLIOTT, E., AND MEEDS, J.

Spectrographic Analysis of Low-alloy Steel. *J. Iron Steel Inst. (London)*, 157, 391-409 (1947).

C. A., 44, 4824i (1950).

A statistical examn. of a large no. of detns. of Si, Mn, Cr, Ni, and Mo in a single low-alloy steel has been made; approx. 60,000 readings were taken from approx. 9000 lines in 30 spectrograms on each of 31 plates. The errors contributed by (a) excitation response, (b) plate variability, and (c) photomicrometry, had min. values corresponding with standard deviations of 0.9, 0.7, and 1% of the Cr content. Errors due to (a) were reduced by the use of Ag or graphite auxiliary electrodes and homologous Cr/Fe line pairs. The total variability due to (a), (b), and (c) corresponded with a standard deviation of 1.9% of the Cr content.

2781. SMITH, D. M.

Progress in Analytical Applications of Emission Spectrography in Great Britain During 1945-46.

Spectrochim. Acta, 3, 89-104 (1947).

C. A., 42, 2544e (1948).

This review summarizes the content of 41 published papers.

2781a. SMITH, D. M., AND WIGGINS, G. M.

Spectrographic Analysis of High-purity Copper. A Note on the Use of the Constant Current D.-c. Arc.

Proc. XIIth Intern. Congr. Pure Appl. Chem. (London), 5, 945-50 (1947) (Pub. 1953).

C. A., 47, 7937f (1953).

Lines are given for Ag, Ni, Pb, Fe, Mg, Mn, Ca, Si, and Al.

2782. SMITH, G. S.

Spectrographic Analysis: Russian Circuits for Excitation Sources.

Met. Ind. (London), 70 (2), 23-24 (1947).

Spectrochim. Acta, 3, 455 (1948).

This article describes several circuits (diagrams of which are reproduced) recently developed in the U.S.S.R., the references covering the period 1939-45. The principal types discussed are as follows: (1) The Raisky controlled spark, employing an auxiliary gap between tungsten electrodes; (2) The Sventitsky interrupted a.-c. arc (with high-frequency triggering); (3) The "Impulse Arc" (Mandel'shtam and Levintov), devised for the determination of impurities in non-conducting and refractory materials, in which the light emission is recorded only when a high voltage discharge is superposed on the carbon arc discharge.

Comparative tests, carried out by Landsberg, using a simple condensed spark, a Feussner spark and a Raisky spark, showed the Raisky spark to be the most stable of the three sources.

2783. SMITH, R. W. AND HOAGBIN, J. E.

Spectrographic Analysis of Zinc-base Alloys.

Anal. Chem., 19, 86-92 (1947).

C. A., 41, 1951e (1947).

Rapid analysis of zinc-base alloys can be based on automatic operation of the spark and spectrograph. A calculating board is used to convert galvanometer deflections to percentages. The spark circuit utilizes a moderate capacity and a very high added inductance to reduce background and gain sensitivity for the trace elements. By use of this circuit, detns. can be made of Al, Cu, Mg, Fe, Pb, Sn, and Cd.

2784. SPIEGELBERG, P.

Examination of Photographic Plates for Spectrographic Analysis.

Jernkontorets Ann., 131, 181-91 (1947).
C. A., 41, 6166e (1947).

Former investigations by the Swedish Metallographic Inst. have shown that the accuracy of the spark method of spectrographic analysis is affected by photographic limitations such as the type of plates used. In this investigation the following types of plates were examined: Ilford Process and Ilford Chromatic, Ilford Thin Film Half Tone, Ilford Ordinary, Kodak Spectrum Analysis No. 1 and No. 2, Gevaert Superchromosa, and Agfa Spektral Blau Hart. The contrast and the root-mean-square deviation from the av. d. were detd. for a no. of these plates. A formula was developed for computing the root-mean-square deviation due to plate grain from the av. concn. obtained by spectrochem. analysis. Measurements of contrast were made for a no. of wave lengths from 280 to 430 m μ . In these the d. fluctuations due to grain were found to be independent of the wave length, while the root-mean-square deviation was found to be inversely proportional to the sq. root of the photometered area. Measurements for 3 sizes of photometer slit confirm this.

2785. STAAHL, G. E. AND HALLIWELL, G. P.
 Spectrographic Analysis. Brass and Bronze Ingot Production.
Am. Foundryman, 12, No. 3, 51-7 (1947).
C. A., 42, 2206e (1948).
 Cf. *C. A.*, 39, 1115^a.

The application of quant. and semiquant. spectrographic analysis to Cu-base alloys is described. Six applications of this technique, which are discussed, are the control of a large reverberatory furnace, checking a small furnace and pot production for minor elements and impurities, analysis of scrap and stock materials, as a qualitative aid in analysis by chem. methods, sorting of alloys, and customer service analysis. The spark and arc conditions are described. An av. error of about 3-4% depending upon the constituent and percentage range is realized.

2786. STACE, H. C. T.
 Flame Excitation Methods for Quantitative Chemical Analysis.
Australian Chem. Inst. J. & Proc., 14, 144-50 (1947).
C. A., 41, 6487c (1947).

The principle of flame photometry is outlined, and 2 techniques for flame excitation of samples for spectrochem. analysis are described and reviewed: the Lundegårdh method (*C. A.*, 23, 3641), in which a soln. of the sample is sprayed into an air-acetylene flame, and the Ramage method (*C. A.*, 23, 5429), in which the solid sample is fed into an oxy-coal gas flame. The error of analysis for each method is given, and the factors contributing

to this error when a photographic plate is used to record the spectra are indicated.

2787. STRASHEIM, A.
 Purification of Electrode Carbons. A Comparison Between the Methods of Standen and Kovack, and Staud and Ruehle.
Union S. Africa, Dept. Agr., Sci. Bull. No. 264 (Fruit Research Tech. Ser. No. 13), 13 pp. (1946-47).
C. A., 43, 5336i (1949).

Two methods to improve the purity of purchased carbons are described as follows: (I) Chem. treatment of the electrodes in a hot soln. of equal vols. of HNO₃ and HCl followed by washing thoroughly in distilled H₂O. This was followed by drying and subjection to a temp. of 1000-1100° in atm. of NH₃, and a treatment in an atm. of Cl₂. The electrodes were allowed to cool in a quartz dish. The purity of the electrodes was further improved by burning them in an arc of 10 amps. for 1.75 min. (II) A second sample from this consignment of electrodes was heated in a SiO₂ crucible to redness and allowed to cool. These were heated in a 1:1 soln. of H₂SO₄ for 24 hr. and washed thoroughly with H₂O and dried. The spectrographic analyses of the graphite rods purified by Methods I and II was conducted by (1) the a.-c. arc method, (2) the intermittent arc method, (3) the d.-c. arc method. The results showed that after treatment of the C according to the methods given, the raies ultimes of the elements V, Ti, Cu, and Fe completely disappeared. The ultimate lines of Ca at 3933, 3968, and 4226 Å and of Mg at 2795, 2802, and 2851 Å were all weakened in intensity by both methods. The persistent lines of Si at 2605, 2614, 2618, 2828, and 2881 Å were not affected by Method II, but after treatment by Method I a definite weakening of these lines was observed.

2788. STROCK, L. W. AND HEGGEN, G. E.
 Use of Incompletely Consumed Samples to Illustrate Effect of Fractional Distillation in Carbon Arc Spectrochemical Analyses.
J. Optical Soc. Am., 37, 29-36 (1947).
C. A., 41, 2345g (1947).

In a method devised to det. Mg, Ca, Sr, and Ba in brine residues, BeO was introduced as an intensity standard by mixing the sample with an equal wt. of an intensity standard consisting of 50% BeO in NaCl. These mixts. were combined with 2 parts carbon powder and packed into carbon electrodes for excitation as anodes in a d.-c. arc. In an attempt to secure more reproducible results than were possible with the Be standard, 0.25% Cr₂O₃ was introduced as a second intensity standard into the same mixts. It was found that the excitation of Cr parallels very

closely that of Mg, Ca, Sr, and Ba, and is therefore a more reliable intensity standard than Be for detg. these elements. This led to a comparison of the complete-consumption procedure with a cut-off procedure in which spectra were recorded only about 50 sec. when a sudden drop in arc current occurs and Na color of the arc column disappears. The results are shown in analytical curves whose differences in slope are explained by fractional distn. of the elements and self absorption of the analysis lines.

2789. STRONG, F. C.

Trends in Quantitative Analysis.

Anal. Chem., 19, 968-71 (1947).

C. A., 42, 835i (1948).

A survey of papers published in 1946 and covered in *C. A.* prior to September, 1947 shows that a majority of the papers are concerned with titrimetric analyses but 56% of all papers cover instrumental procedures including colorimetry, spectrophotometry, emission spectrography, instrumental titrimetry, and polarography. Chromatography receives much attention. With respect to the no. of papers, Russian comes next to English. About 58% of all papers are concerned with the analysis of org. compds.

2790. SVENITITSKIĬ, N. S.

Spectral Determination of Some Metalloids.

Bull. acad. sci. U.S.S.R., Ser. phys., 11, 319-25 (1947).

C. A., 42, 1845c (1948).

To det. P in steel it is recommended to use the lines 2149.1 and 2136.2 Å. A C electrode is used as the 2nd electrode in preference to Fe, Cu, Al, or Zn. The diam. of the steel electrode should be about 50 mm. to avoid changes of intensity during the burning. The Fe line 2132.1 Å was used as a comparison line in the working curve. To det. C in iron alloys, with the lines 4267 and 2297 Å it was found necessary to modify the standard spark generator. C can also be detd. approx. with a steelscope.

2791. SVENITITSKIĬ, N. S.

The Grading of Aluminum Alloys with the Steelscope.

Zavodskaya Lab., 13, 1454-9 (1947).

C. A., 44, 4371e (1950).

Comparison lines and operating conditions are given for detd. Mg, Cu, Mn, Fe, and Si in Al alloys with an Fe or Cu counter-electrode and a triggered low-voltage a.-c. arc.

2792. SVENITITSKIĬ, N. S. AND FEDOROV, M. F.

Determination of Silicon with a Steelscope.

Zavodskaya Lab., 13, 626-8 (1947).

C. A., 42, 4403f (1948).

Details of an a.-c. arc generator for use with steelscopes for detn. of Si in steel.

2793. SVENITITSKIĬ, N. S. AND TAGANOV, K. I.

Electric-spark Method for Transferring Samples During Spectral Analysis.

Zavodskaya Lab., 13, 850-3 (1947).

C. A., 42, 8695b (1948).

Sparking between 2 electrodes, one of which is const. (e. g., Cu) and the other the test material, is continued until a definite amt. of the test alloy is transferred to the const. electrode. The test-material electrode is replaced by a 2nd electrode of the same material as the const. electrode. By regulating the amt. transferred and making the conditions reproducible, it is possible to evaluate the concn. of the element from the time that the spectral lines persist. The use of this method for the analysis of metals and alloys on the steelscope makes it possible to conduct the analysis by the evaluation of the abs. intensities of the spectral lines of the admixts. This is important in those cases where it is not possible to select suitable lines for comparison.

2794. SWINGS, P.

Some Comments on the Luminous Sources of the Future in Spectrochemistry.

Rev. universelle mines, 90, 339-41 (1947).

C. A., 41, 7263c (1947).

S. discusses the possibilities of utilizing other sources for spectrographic analysis besides the flame, elec. arc, and spark and describes the microspark for the investigation of a very small surface, of the order of 10 μ in diam., the spark in vacuo, and the hollow cathode of Schüller.

2795. TASSEL, R. VAN.

Spectroscopic Analysis of Billietite.

Ann. soc. géol. Belg., Bull. 70, B 226 (1946-47).

C. A., 42, 2895a (1948).

2796. TIGGELEN, A. VAN, AND WIJNEN, J.

Spectrographic Determination of Deuterium in Mixtures CH_4 + D_2 and HCl + D_2 .

Bull. Soc. Chim. Belg., 56, 312-27 (1947).

Spectrochim. Acta, 3, 655 (1949).

For quant. detn. of D_2 in mixtures with CH_4 and HCl , these mixtures, at a pressure of 1.5-mm. Hg, are placed in a Geissler tube and excited with an electrodeless discharge by means of a Tesla transformer. The Geissler tube is first completely outgassed by heating to 350°C., and Hg vapor is removed by freezing. The quant. detn. of D_2 results from the relative intensities of the lines $\text{H}\beta$ and $\text{D}\beta$. The accuracy of a detn. of D_2 in the range from 15-85 atomic per cent is 1% in a mixture with CH_4 , and 3.5% in a mixture with HCl .

2797. TIKHOMIROVA, N. K.

The Sorting of Light Alloys Using the Steeloscope and the Alternating-current Arc.

Zavodskaya Lab., 13, 221-5 (1947).

C. A., 42, 2908f (1948).

Suitable line groupings are recommended for classifying several Al and Mg alloys according to their Si, Mg, Cu, Ni, Mn, Al, and Zn contents by means of the steeloscope.

2798. TILLEY, C. E., MITCHELL, R. L.,

NOCKOLDS, S. R., WAGER, L. R., ET AL.

Trace Elements in Minerals and Rocks.

A Geochemical Discussion.

Observatory, 67, 98-104 (1947).

C. A., 41, 6176e (1947).

The objects of geochemistry are to det. the abs. abundance of the elements in the earth and their distribution among various types of rock. For quant. detns. of trace elements in rock the emission spectrographic method is advantageous: elements which can usually be detd. are Ga, Li, Cr, Cu, Co, Ni, V, Ba, Mn, Sr, Zr; those which can sometimes be detd. are Ag, Sn, Pb, Sc, Be, Rb, Y, La; those which can be detd. only if specially concd. are Ge, Tl, W, As, Sb, Bi, Zn. Except for B, S, Cl, Br, and I trace elements are more abundant in sedimentary rocks than in sea water. For igneous and meteoric material it seems best to make comparison with the trace-element content of the av. igneous rock in the upper layers of the earth. Certain trace elements show tendencies to concentrate in silicate material, meteorites, etc. Variations in concn. of trace elements in different rock layers are accounted for, according to Goldschmidt's school, on the hypothesis that igneous rocks have been produced out of an initial magma by fractional crystn.

2799. TOSCANI, V.

A Modified Atomizer for the Flame Photometer.

Anal. Chem., 19, 820 (1947).

An attachment for a Meker burner, consisting of a spray chamber and a capillary tube spraying system. The unit of glass or metal, is reported to be easily duplicated and to provide more constant spray.

2800. TOSCANI, V. AND BUNIAK, V.

Sodium and Potassium Content of Meats.

Food Res., 12, 328-331 (1947).

B. A., 22, 1079, abstract no. 11035 (1948).

The Na and K contents of 71 samples of various cuts of meat were detd. by flame photometry. The individual values showed wide variations, while the average values showed good agreement with the published figures.

2801. TUTTLE, H. A. AND NAHSTOLL, G. A.

Mobile Laboratory Speeds Steel Analysis.

Iron Age, 160, No. 13, 68-72 (1947).

C. A., 41, 7306d (1947).

The unit finds use in the inspection and grading of steel scrap or raw materials, checking or sorting steel stock, and identification of semifinished or fabricated parts. A specialized spectroscope used for semiquant. analysis of steel is described. 12 references.

2802. UNSÖLD, A.

Quantitative Analysis of the Spectrum of an Eruptive Prominence.

Z. Astrophys., 24, 22-37 (1947).

C. A., 42, 8636f (1948).

Abs. intensities are communicated for emission lines of H, He I, He II, Mg I, Ca I, Ti II, Cr II, Fe I, and Sr II observed in an eruptive prominence on the sun during the eclipse of May 9, 1929. From these data are derived the relative nos. of radiating atoms in each excitation state and their total nos. over 1 sq. cm. of the sun's surface. It is found that the chem. compn. of the prominence does not differ essentially from that of the sun's atm.; that most of the H is ionized, whereas most of the He is neutral.

2803. VANCE, E. R.

Rapid Steel Analysis.

Steel, 121, No. 12, 92, 94 (1947).

C. A., 44, 4824g (1950).

Mn, Si, Cr, Ni, Mo, Cu, V, and W can be detd. within 40 sec. by means of a direct-reading spectrometer in which the emitted light is directed on a 3-m. focal-length grating, which affords a dispersion of 2.8 Å per mm. for the spectral region of 2800-4400 Å in the second order, and the radiated light after passage through exit slits, one for each element, falls on to photomultiplier tubes which generate a current proportional to the amt. of light received.

2804. VAN SOMEREN, E. H. S.

Continental Wartime Developments in Spectroscopic Technique.

J. Sci. Instruments, 24, No. 9, 225-30 (1947).

Spectrochim. Acta, 3, 436 (1948) (an abstract).

A review of published work (59 references) with particular emphasis on work unlike that carried out in Britain. The principal sections of the paper deal with apparatus (high dispersion spectrographs, single-purpose visual spectroscopes, microphotometers and an infrared spectrometer), light sources (flaming arc of Gatterer, interrupted d.-c. and a.-c. arcs with high-frequency ignition and methods for stabilizing spark discharges), technique (methods of manipulation and sampling, analysis of powders and solutions, electrolytic deposition, localized analysis) of inclu-

sions and the use of a spectrograph in which the slit is replaced by a quartz cylindrical lens), methods (breadths of lines as a measure of relative intensities, studies of the slope of concentration-calibration curves, and trace analysis). The concluding section on scope covers special and borderline cases, e.g., archaeological applications, excitation of halogens and pathological uses of absorption spectra.

2805. VAN SOMEREN, E. H. S.
Spectrochemical Abstracts. Vol. III.
1940-45.

London: Adam Hilger (1947), 112 pp.
C. A., 42, 1132g (1948).

This is a continuation of the abstracts of Vol. I (1933-37) and Vol. II (1938-39). Volume III includes 467 entries.

2806. VASSY, E.

Recent Improvements in a Recording Microdensitometer.

Congr. groupe avance. method. anal. spectrograph. produits met., 8th Congr., Paris, 27-8, 135 (1947).

C. A., 42, 3223h (1948).

Cf. *Science et inds. phot.*, 16, 1, 65 (1945).

The sensitivity of the previously reported instrument has been increased by an electronic circuit using a phase-shift principle; the details are not given. This permits use of a narrower exploratory slit. A second improvement consists of an automatic control of the speed of the recorder motor actuated by the rate of change of the output of the photoelec. cell, so that the motor will run slower when recording rapid changes of optical d. than when gradual changes are being recorded; this gives adequate time for complete swings of the stylus at all points, while maintaining min. time required for scanning the whole plate.

2807. VSELOVSKAYA, I. M.

A Spectrographic Method for Analyzing Basic Open-Hearth Slags, Using Briquets.

Zavodskaya Lab., 13, 219-21 (1947).

C. A., 42, 2891c (1948).

Cu is prepd. either by adding concd. H_2SO_4 to Cu_2O or powd. Fe to $CuSO_4$ soln. About 60% or more by wt. of the damp Cu powder is added to the slag. About 1 g. of the mixt. is ground in a mortar and briquetted in a hand press at 1000 kg./sq. cm. to form a cylinder 6 mm. in diam. and 615 mm. high. The briquet was run by using a Sventitsky arc and a 3-mm. analytical gap. Operating ranges were as follows: SiO_2 15-30%, CaO 25-55%, FeO 6-20%, MgO 5-20%, MnO 2-20%. On quintuplicates, the precision for Mg was 7-9%; for Ca, 3%.

2808. VVEDENSKIĬ, L. E.

Spectral Analysis of Fused Metals and Solutions.

Bull. acad. sci. U.R.S.S., Sér. phys., 11, 281-2 (1947).

C. A., 42, 1843b (1948).

An elec. discharge is formed between a fixed electrode and a jet of liquid flowing out of a funnel made of cast Fe, Pt, quartz, or glass. An arrangement for silumin analysis is shown and spectrographic methods are reviewed for detg. 5 elements in less than 5 min.

2809. VVEDENSKIĬ, L. E.

Copper in Aluminum Alloys.

Metal Ind., 71, No. 1, 9 (1947).

C. A., 41, 5812f (1947).

For spectrographic detn. of Cu in Al alloys, with the normal condensed spark the lines Cu 3247-Al 3050 can be used for Cu contents of 0.01-0.40%, but at 0.40% the resonance line of Cu 3247 shows strong satn. and the sensitivity is greatly decreased. Various types of equipment are described for spark generation and adjustment. The intensities of all the Cu lines depend greatly upon the length of the spark gap. With Cu contents of 6-14% the detn. is strongly affected by variations in Si content. Thus it is necessary to use 3 calibration curves: (1) for alloys contg. 0.1% Si (2) for 1-2% Si, (3) for 2-6% Si. Si is detd. first and then Cu in accordance with the appropriate graph.

2810. WALTERS, S. H.

A Direct-Reading Spectrometer for Ferrous Analysis.

Open Hearth Steel (Proc. Conf. Am. Inst. Mining Met. Engrs.), 30, 281-9 (1947).

C. A., 42, 5279i (1948).

Approx. 40 sec. from the time that the electrodes are placed in the instrument the percentage concn. can be read on the dials for 8 elements, not including C, S, and P, which do not lend themselves to spectrographic analysis. Most of the work on steels has been with alloys up to about 5.0%. With an alloy content of 20%, the standard deviation would be about 2 or 3% of the amt. present.

2811. WATSON, K. DEP.

Beryllium in Pegmatites.

Am. Mineral., 32, 94 (1947).

C. A., 41, 1960a (1947).

Spectrographic qual. analyses of silicates from pegmatites showed that more contg. traces of Be were found in a beryl pegmatite than in a pegmatite free from beryl.

2812. WEBER, K. AND RUKAVINA, J.

Studies in Spectral Analysis. II. Determination of Thallium in the Body.

Archiv Kem., 19, 93-100 (in English, 100) (1947).

C. A., 42, 7818h (1948).

Tl can be detd. directly in biol. material by the spectroanalytic method without preliminary ashing, and without special purification of the final soln. The emission line used (535.05 m μ) is the most intense line of the spectrum. A practically linear relationship was found between the log of Tl concn. and the log of galvanometer deflection caused by the given intensity of the black line of the spectrum photograph. An arc discharge between carbon electrodes is used for illumination. In the crater, 4 mm. deep, in the electrode, is placed 0.03 cc. of sample. A special device for illuminating the spectrograph slit consists of 3 lenses and an auxiliary slit between the source of light and the main slit. The light from the arc discharge passes through the first lens ($f = 80$ mm.), which gives a sharp image of the source at the spot of the auxiliary slit. The second lens ($f = 160$ mm.) projects the image of the auxiliary slit directly into the objective of the spectrograph. The third lens ($f = 200$ mm.) throws the same image of the auxiliary slit also into the objective, but not into the admitting slit. This arrangement permits an intensified light to pass into the camera of the spectrograph and thus fall without any dissipation on the photographic plate in front of the objective; this produces uniform blackening of all the lines and of any given line along its length. The spectral method gives results that are as reliable as those of the ordinary iodometric procedure. 9 references.

2813. WINKLER, G.

Industrial Spectrographic Analysis of Aluminum and Its Alloys.

Chimia (Switz.), 1, 248-52 (1947).
C. A., 42, 4087h (1948).

The spectrograph in the Al foundry serves to det. the impurities in the crude metal with a fairly simple app. From technical and instrumental considerations during the last year in W.'s labs., a procedure for making an analysis was adopted. For the analysis of crude and pure metals of the usual com. grade, the spectrum is produced by a condensed high-frequency spark. Si and Fe are detd. to 0.05-1.0% and Cu, Mn, Ti, Ni, Cr, Mg, Zn, Pb, and Sn between 0.02 and 0.25%. Cu, Mn, and Ti can be detd. when present from 0.002 to 0.02% by special standard samples. The second method makes use of Agfa pos. film and a noncalibrated evaluation of the spectrum. The use of film instead of plates speeds up the photographic operation so that a single analysis can be made in 15 min. The third method is used for alloys contg. Cu and is similar to method 2 except for a different spark time as well as the use of other standard samples and hardened plates. The fourth method is used for the analysis of scrap as well as for the trace

elements in crude metals and is similar to the a.-c. interrupted arc method of Pfeilsticker (C. A., 35, 6211⁷). The construction and cost of several types of spectrographic installations are given.

2814. WOODRUFF, J. F.

A Rapid Spectrographic Control Method for Determination of Lime-Silica Ratios in Open-Hearth Slags.

Open Hearth Steel (Proc. Conf. Am. Inst. Mining Met. Engrs.), 30, 179-84 (1947).
C. A., 42, 5798f (1948).

Duplicate detns. of a slag sample from the open hearth or blast furnace can be made in 15 min. Spectroanalysis of 47 chemically analyzed slag samples indicated that 91% of the lime-silica ratios were within 0.3 unit of those detd. by chem. methods. The sample is powd. to pass 100 mesh and is packed into a $\frac{1}{8}$ -in. $\times$ $\frac{1}{8}$ -in. stepped tip negative C lower electrode. The counter C electrode has an included angle of 120°, spaced 2 mm. from the opposite electrode. The circuit is adjusted to give an overdamped arclike discharge. The sample is arced for 3 sec. before the exposure is begun and then an exposure is made for 10 sec. A 50- μ slit is employed in a Baird 3-m. grating instrument with the grating ruled 15,000 lines per in.

2815. ZAIDEL, A. N. AND FRISH, S. E.

Spectrograph for Geological Prospecting.

Zavodskaya Lab., 13, 585-8 (1947).
C. A., 42, 5279h (1948).

The spectrograph is portable and can photograph a spectrum region from 2400 to 4600 Å. Ordinary film can be used. Over-all length is 11 cm.; the av. dispersion is 20 Å/mm. App. is suitable for analyzing most ores for metals.

2816. ZAK, K. K.

Spectral Analysis of Small Amounts of Impurities in Antimony and in Lead Containing Antimony.

Bull. acad. sci. U.R.S.S., Sér. phys., 11, 301-2 (1947).

C. A., 42, 1843i (1948).

A method of detg. 0.005-0.01% of Cu and Bi.

2817. ZAKHARIYA, N. F.

The Quantitative Spectrographic Analysis of Several Light Alloys Using a Spectrograph with Glass Optics.

Zavodskaya Lab., 13, 226-7 (1947).
C. A., 42, 2889i (1948).

From 0.006 to 0.1% Al in bronzes was analyzed spectrographically with Al 3994 and 3961 and Ni 3963 and 3973. Sn was detd. from 1 to 6% with Sn 4525 and Ni 4547. Mg up to 1.25% was detd. with Mg 5173 and Ni 4984. Above 1.0%, Mg 5167 was used. For Mn in Al, Mn 4783 and 4823 and Ni 4829,

4831, and 4787 were used. Spectrographic analysis usually varied by 5-10% from chem. analysis.

2818. ZANDER, J. M. AND TERRY, J. H.
Quantitative Spectrographic Analysis of Powdered Ceramic Materials.

J. Am. Ceram. Soc., 30, 366-70 (1947).

C. A., 42, 1399d (1948).

For over a yr. spectrographic methods have been used satisfactorily to check all ship-

ments of milled minerals and powd. industrial chemicals. A briquetted sample is used as the upper electrode of a 1.5-m. grating spectrograph with an electromagnetic timer and shutter. The power for excitation was furnished by a 5-kv.-amp. input Multisource control unit. Three tables give the needed data regarding briquet compn., spectrographic and Multisource specifications, and line pairs, for feldspar, fluorspar, rutile, zircon, SiO_2 , and BaCO_3 . Details of procedure are given.

1948

2819. ABRAMSON, S. I.

Obtaining Sparklike Discharges with the Activated Alternating Current Arc.

Zavodskaya Lab., 14, 1135-6 (1948).

C. A., 45, 4579i (1951).

By coupling the ignition circuit to the power circuit directly through a 5-10 μH inductance, and keeping all leads as short as possible, A. obtained overdamped discharges in which the instantaneous current reached approx. 300 amp.

2820. ADDINK, N. W. H.

General Method for Quantitative Spectrochemical Analysis.

Rec. trav. chim., 67, 690-6 (1948) (in English).

C. A., 43, 7365i (1949).

A variation of Harvey's method of quant. spectrochem. analysis (Method of Semi-Quant. Spectrographic Analysis, 1947 (*C. A.*, 42, 4498g) is described which eliminates the need of a sep. chem. analysis. The first part consists in a rough estn. from spectra obtained by arcing material in a 2 min. C arc; the second consists of an exact detn. of Harvey's sensitive factor, K, with a 10 min. C arc and weighed samples. This is accomplished by successive addns. of the element in question.

2821. AIDAROV, T. K.

The Sorting of Zinc Alloys with the Steeloscope.

Zavodskaya Lab., 14, 367-8 (1948).

C. A., 43, 1286g (1949).

A choice of lines is given for estg. Al, Cu, and Pb in Zn alloys, by using a Fe counter-electrode and an a.-c. arc.

2822. ALEXANDER, A. E.

Spectrochemical and Spectrophotometric Analysis of Rubies and Sapphires.

J. Gemmol., 1, 4-8 (1948).

C. A., 43, 8981h (1949).

Spectrochem. analyses are given for natural and synthetic ruby and synthetic star ruby. The spectral reflection factors in the visible spectrum are shown for natural and synthetic ruby and sapphire.

2823. ALEXANDER, O. R. AND BISKE, V. M.
Spectrographic Determination of Tin and Aluminum in Beer.

Am. Soc. Brewing Chemists, Proc., 1948, 69-75.

C. A., 44, 275d (1950).

A rapid spectrographic procedure for detg. Al and Sn in beer is discussed. The reagents and standards, and the procedure used for the prepn. of the beer sample are described. Al and Sn can be detd. in the same sample. A spectroscope buffer and an internal standard element not present in beer are added. It should resemble tin with respect to any chem. or phys. means used to effect a concn., behave in similar manner when exposed to action of elec. discharge, especially with respect to rate of distg. during arcing. It should have a spectrum which permits selection of lines of the proper wavelength range, of proper intensity, and lines which in combination with certain tin lines form the so-called invariant or homologous pairs. The method is precise and makes possible an evaluation of the effect of dissolved tin on those changes in beer which produce the undesirable chill haze.

2824. ALUMINUM RESEARCH INST. 1948.

Analytical Methods for Aluminum Alloys.

Chicago: Aluminum Research Inst. (1948), 103 pp.

Reviewed in *Am. Foundryman*, 14, No. 2, 63 (1948).

The sampling of aluminum alloys for analysis, including remelting and casting, is discussed and details are given for chemical, photometric, and spectrochemical methods of analysis. Tables of wavelengths and concentration ranges are given for the spectrochemical determination of Cr, Cu, Fe, Mg, Mn, Ni, Pb, Si, Sn, Ti, and Zn in aluminum alloys.

2824a. AMERICAN SOCIETY FOR TESTING MATERIALS SYMPOSIUM ON SPECTROSCOPIC LIGHT SOURCES.

Technical Publication. STP 76 (90 pp.).

American Society for Testing Materials, Philadelphia (1948).

Four papers and discussion are given relat-

ing to the present status of excitation in spectrographic analysis, study of controlled spectrographic spark source, some properties of gas discharges used as spectral sources, and short period behavior of spectroscopic light sources.

2825. ARGYLE, A., AND PRICE, W. J.

A New Method of Photographic Evaluation in Spectrographic Analysis.

J. Soc. Chem. Ind. (London), 67, 187-90 (1948).

C. A., 43, 961e (1949).

A simple nomographical method of evaluation of minor constituents in spectrographic analysis is given. Two-line pairs were used which were produced by one element line in conjunction with 2 internal-standard lines and one element line in conjunction with one internal standard and the appropriate use of a step filter.

2826. ASHKINAZI, M. S.

The "Single-Standard" Method.

Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., 12, 459-61 (1948).

C. A., 44, 3835d (1950).

The simplified spectral-analysis method (*Zavodskaya Lab.*, 10, 624 (1941); *C. A.*, 37, 2301*) was applied to the detn. of Mn, Mg, Cu, and Fe, in Al alloys, with results not inferior to those of the usual 3-standard method. Further applications are to Mn, Cr, and Ni, in steel, by the line pairs Mn 2933-Fe 2937, Cr 2677-Fe 2689, and Ni 3414-Fe 3399, resp. In the detn. of Al, by line pairs of Al alone, 2652-2568, 3050-3057, and 2652-3057, the best independence of the intensity ratio of the contrast coeff. of the photographic plate was found with the 2nd line pair.

2827. AVERBUKH, M. M. ERINA, I. I., AND STREL'TSOV, I. G.

Determination of Silicon in Malleable and Gray Cast Irons and Steels with a Steeloscope.

Zavodskaya Lab. 14, 110-12 (1948).

C. A. 43, 967g (1949).

The test specimen served as one of the sparking electrodes, and C steel contg. 0.20-0.24% Si and 0.4-0.6% Mn was the const. electrode. The dimensions of the const. electrode were 1.5-2.5 × 4.5-5.5 mm.; the spark-gap was 2.5 mm. Excitation source was a condenser spark in an ordinary set-up (transformer 220/21,000 v., current self-induction coil 9.5 cm. in diam., distance between turns 0.8 cm.; in analyzing malleable cast iron, 16 turns were used and for gray cast iron 10 turns). For the lines N 5551.95 and Fe 5563.60 Å, equality of intensity is obtained after 1.5 min. of sparking. All analytical factors are retained within the interval of 15-18 turns for malleable and 9-12 turns

for gray cast iron. If necessary, the self-induction should be varied until the intensities are equal. For Mn concn. greater than 1%, the relation of the intensities of the lines Si/Fe and Si/N was somewhat increased. Cr, Ni, W, and V had no effect on the detn. of Si. Results with over 400 samples were satisfactory; in only one analysis the detn. was 0.8-0.9% instead of 1.1-1.2%.

2828. BABAEVA, A. V. AND LAPIN, E. S.

Spectroscopic Determination of Iridium, Platinum, and Palladium in Refined Rhodium.

Izvest. Sektora Platiny i Drugikh Blagorod. Metal., Inst. Obshehei i Neorg. Khim., Akad. Nauk S.S.S.R. No. 22. 145-8 (1948).

C. A., 44, 10583i (1950).

For detn. of these metals there was used an activated a.-c. arc and highly purified C electrodes in a Hilger quartz spectrograph. Ir was detd. from its line at 3220.79 Å. For comparison there was used the Rh line at 3207.29 Å at Ir contents of 1-0.1% and the Rh line at 3206.09 Å for Ir contents of 0.1-0.01%. Pt was detd. from its line at 2997.96 Å. For comparison there was used the Rh line at 3008.93 Å, at Pt concns. of 0.1-0.01% and Rh line 2991.74 Å for Pt below 0.01%. The preferred line for Pd was at 3242.71 Å. Care must be exercised because nearby is the Ti line at 3241.989 Å. The Rh line at 3237.66 Å was used for comparison. For 0.111-0.861% Ir the av. error was ±3.33%; for 0.0038-0.080% Pt the av. error was ±6.75%, and for 0.005-0.1% Pd the av. error was ±10.5%.

2829. BANNISTER, L. C. AND PRICE, R. H.

Effect of Melting Conditions on the Spectrographic Determination of Copper in Lead Alloys.

J. Inst. Met., 75, 151-62 (1948).

Spectrochim. Acta, 4, 181 (1950).

The preparation of lead-tin-copper (0.035 to 0.065% Cu) and lead-tin-antimony-copper (0.020 to 0.08% Cu) alloy standards is described and results of spectrographic checks are given. It is deduced experimentally that the lead alloys must be heated to 600 to 700°C. in order to obtain a true copper figure, and the best method of heating was to direct a coal gas/air flame downwards on to the molten surface of the alloy. The added quantities of copper were corrected for the amounts of copper found in the dross to give the true copper contents. Samples rolled from the stick castings were used as spark electrodes (open-circuit secondary voltage 15,000 v; capacitance 0.0125 μF; self-inductance 0.03 mH; 3 mm gap and no pre-sparking) and the line pair measured was Cu 3273.9/Pb 2628.3. Concentration-calibration curves

show an effect of the presence of small amounts of antimony on the determination of copper in lead-tin alloys. Different methods of preparing sample electrodes for routine analysis were also studied.

2830. BARDOCZ, A.

Electric Spark Generator for Spectrochemical Analysis with Aperiodically Damped Charging Current Circuit.

Műgyetemi Közlemények No. 1, 2-33 (1948) (in English).

C. A., 43, 448e (1949).

The basic principles of spark-generator circuits are established. Numerous exptl. results are interpreted. The advantages of the aperiodically damped spark-generator in comparison with periodic damping are summed up in detail.

2831. BARDOCZ, A.

Synchronous Switches for Spark Generators Used in Spectrochemical Analysis.

Műgyetemi Közlemények 1948, part 3, 140-57.

C. A., 43, 5695d (1949).

2832. BARNES, R. B., BERRY, J. W., AND HILL, W. B.

The Flame Photometer.

Eng. Mining J., 149, No. 9, 92-4 (1948).

C. A., 42, 8030f (1948).

The sample is poured from a volumetric flask into a funnel. The result is indicated on a galvanometer in ppm. The atomized sample is blown into the gas flame, the intensity of the resulting flame color is registered by a photometer and gives a measure of metal content of the sample. Accurate analyses of solns. contg. Na, K, Li, and Ca and of Na and K in potash ores, analysis of clays, feldspars, Ca in magnesite and certain possibilities of other applications are suggested.

2833. BARRET, P.

A Convenient Process for the Coloration of Flames by Metallic Vapors.

Compt. rend., 226, 470-2 (1948).

C. A., 42, 6236f (1942).

The soln. of the salt to be used for coloring the flame is contained in a small tray which is placed in a horizontal glass cylinder of large diam. that carries either the combustible gas or the air supply to the burner. A Pt anode in the form of an annular ring is placed parallel to and above the surface of the salt soln. in the tray. The cathode, a piece of Pt wire, is introduced through the bottom of the tray. The spark set up between the electrodes atomizes the soln. there and the mist is carried on to the burner. The optimum spark gap for 20,000 v. is about 15 mm. There is no atomization when the current direction is reversed. The spectra of Cu, Tl, and all the

alkali and alk. earth metals were observed in this manner.

2834. BAYLISS, N. S. AND DAVID, D. J.

Filter Paper Pellets in the Spectrochemical Analysis of Solutions.

J. Soc. Chem. Ind. (London), 67, 357-8 (1948).

C. A., 43, 2114h (1949).

Sensitivity and reproducibility of the pellet method were studied with solns. contg. B, Cu, Mn, Mo, Na, and Pb with graphite or Cu arcs. The results as summarized in 2 tables indicate a useful working range and fair reproducibility.

2835. BELKE, J., AND DIERKESMANN, A.

A Flame Photometric Method for Determination of Sodium, Potassium, and Calcium in Biological Fluids.

Arch. exptl. Path. Pharmacol., 205, 629-46 (1948).

C. A., 43, 7070d (1949).

The fluid is nebulized into an air-C₂H₂ flame and the intensity of emission at appropriate wave lengths is detd. photometrically. The app. is shown.

2836. BERTOLANI, M.

Rare Earths in the Bazzite of Baveno.

Rend. soc. mineral. ital., 5, 73-8 (1948).

C. A., 46, 3912a (1952).

By a Zeiss Qu 24 spectrograph the presence of Al, Be, B, Ca, Fe, K, Li, Mg, Mn, Na, Sc, Si, Sn, Ti, Y, Yb in the bazzite of Baveno was found. A further investigation showed the absence of Th, U, Zr, In, Ge, Nb, Ta, Re, Ru, Tu, Lu, Tb, Ho, Er, Sm, and Pr. The intensity of the rare earth lines was max. for Sc, good for Y and Yb, very light for La, Ce, Dy, Gd, and Nd.

2837. BERTON, A.

Comparison, by Means of Spark Spectra, of Normal and Hemophilic Blood Serums.

Bull. soc. chim. biol., 30, 654-7 (1948).

C. A., 43, 4357a (1949).

No differences were found in Ca, Mg, Cu, and P contents.

2838. BERTON, A.

Differentiation of Papers by Means of Spark Spectra in Ultraviolet Light.

Chim. anal., 30, 124-6 (1948).

C. A., 42, 5373b (1948).

If a condensed elec. spark is passed across a sheet of paper, carbonization takes place and there is local volatilization; spectra are obtained from the elements present in the paper (cf. *C. A.*, 42, 833e). This can be used for the identification of different kinds of paper and also for detg. the contents of aq.

solns. with which the paper can be impregnated.

2839. BERTON, A.

Spectrographic Analysis of Solid Substances.

Compt. rend., 226, 892-4 (1948).

C. A., 42, 4403e (1948).

An app. is described for exciting, with a condensed spark discharge, the spectra of solid substances in powder form. The lower of a pair of vertically mounted graphite electrodes is a cup placed between an auxiliary pair of horizontal graphite electrodes whose function is to heat the cup contg. the analytical specimen when they are carrying a.c. of 10 amps. at 110 v. potential. With this scheme one may obtain the lines of the most volatile elements such as Hg, Bi, Cd, or Pb, without interference from the many lines of more refractory elements.

2840. BERTRAND, G. AND BERTRAND, D.

The Presence and Determination of Rubidium in Arable Soils.

Ann. agron., 18, 1-3 (1948).

C. A., 42, 4697g (1948).

See *C. A.*, 41, 241h (1947).

2841. BERTRAND, G. AND BERTRAND, D.

The Rubidium Content of Various Families of Phanerogams.

Compt. rend. acad. agr. France, 34, 829-31 (1948).

C. A., 43, 3494i (May 10, 1949).

With reference to monocotyledones, the av. Rb content of 29 species of grass is 11.9 ppm. while that of other families, 26 different species, is 20.2 ppm. The amt. of Rb in the dicotyledones varies from 11.2 ppm in the labiates in 15 species examd., to 31.2 ppm in the 11 caryophyllaceous species analyzed.

2842. BLINOV, V. I.

Determination of Niobium in Stainless Steel with the Aid of the Steeloscope.

Zavodskaya Lab., 14, 1494-5 (1948).

C. A., 46, 7931f (1952).

Use of the Nb lines 5095.3 and 4573.1 Å is recommended. With the line 5095.3, it is advantageous to use the line 5098.7 of Fe for comparison. For steel contg. 1.5% Nb, the intensity of the Nb line 5095.3 is equal to the intensity of the Fe line while the intensity of the Nb line 4573.1 is close to the intensity of the Cr line 4569.6.

2843. BOROVIK, S. A. AND BOROVIK-ROMANOVA, T. F.

Influence of Total Composition of a Sample on the Intensity of the Spectral Lines in Spectrum Analysis of Mineral Raw Materials.

Izvest. Akad. Nauk S.S.S.R., Otdel Khim. Nauk, 1948, 161-4 (1948).

C. A., 42, 7196b (1948).

The influence of Na and K salts on the line intensity of Li, Rb, Ti, and V under various conditions of excitation was studied. NaCl and KCl in an arc (d.c.) enhance the intensity of neutral Ti and V atoms and weaken the lines of the ionized atoms (the material used was a sample of soil); the intensifying effect was also observed in examn. of soln. by the spark method. Various salts of Na mixed with the soil sample gave different degrees of variation of intensity of the 6707.8-Å line in an a.-c. arc, depending apparently on the variation of rate of evapn.; only NaCl intensified the line, while Na_2HPO_4 , $\text{Na}_2\text{C}_2\text{O}_4$, and Na_2CO_3 failed to change the intensity of this line of Li; similar results were obtained in d.-c. arc; KCl was somewhat more effective than NaCl, while CuCl_2 weakened the line considerably and Cu_2Cl_2 had a smaller effect. The admixt. of 1:1 KCl intensified the Li line so as to give an apparent increase of Li concn. by 6-fold; NaCl effect was a 4-fold intensification. When natural CaSO_4 was used as the Li-bearing sample, Na_2SO_4 was found to have a greater intensification effect than NaCl, and Na_2CO_3 gave a slight intensification. It was shown that in arc excitation the soil sample loses its Li rather rapidly (in samples used it was absent in the last 3 exposures of a series of 6, spaced every 30 sec.); this holds for admixts. with NaCl, but when Na_2SO_4 was added, the Li line was absent in early exposures and appeared in the later ones. Study of spectra with high-voltage (flame) arc on solns. contg. 0.001% Li and 0.01-1.0 N solns. of NaCl or Na_2SO_4 , showed a gradual loss of intensity of the Li line in both cases, with Na_2SO_4 being more effective than NaCl. The use of the high-voltage arc (which is poor in lines of neutral atoms) in a study of NaCl and Na_2SO_4 effects on the 3273.96 line of Cu, 3414.76 line of Ni, and 2801.1 line of Mn, showed that both salts reduce line intensity, with Na_2SO_4 being most effective. The 4226.73 line of Ca vanishes at 0.1 N concn. of NaCl or Na_2SO_4 .

2844. BOROVIK-ROMANOVA, T. F.

Quantitative Spectroscopic Determination of Lithium in Soils.

Khur. Anal. Khim., 3, 362-5 (1948).

C. A., 43, 9318c (1949).

To det. Li in soils a tri-prism Zeiss spectrograph operating on 120-v. a.c. at 12 amp. with C electrodes was used. Dry a soil sample at 105° and mix 1:1 with NaCl. Place a 0.022 g. sample in the cavity (8 mm. deep) of the lower electrode and screw on the lid (*C. A.*, 38, 62347). The slit was 0.01 mm. and the exposure time 3.5 min. Not all of the sample need be evapd. since Li is one of the first to volatilize. Li was detd. from the line 6707.86

- Å. The amt. of Li in an analyzed soil sample was estd. from the darkening of the Li line and of the contiguous area by comparison with soil samples contg. 0.002, 0.0045, 0.0075, and 0.0095% of Li. The spectra of the sample and 3 or 4 standards were exposed on the same plate. The results in the form of log concn. vs. ΔS (difference in darkening) were plotted. The mean relative error of this method was $\pm 8\%$. The limiting sensitivity was $2.10^{-4}\%$ Li.
2845. BORSOVA, A. V. AND SOROKINA, N. N. Spectrographic Analysis of Permalloy. *Zavodskaya Lab.*, 14, 1098-1100 (1948). *C. A.*, 45, 4801g (1951).
- Samples were sparked as received with an Al counter-electrode; the power source was an uncontrolled Feussner generator with no series inductance.
2846. BŘESKÝ, L. Spectral Analysis of Colored Metals. *Hutnické Listy*, 3, 212-13 (1948). *C. A.*, 43, 3314b (May 10, 1949).
- With a Zeiss spectrograph Qu 24, a Feussner generator for sparks, and a Pfeilsticker arc interrupter, B. was able to det. 0.1-0.5% Mg in Cu, 0.005-0.1% P in Cu, 0.1-1.0% Cd in Cu, 1.5-6% Sn, and 0.15-0.5% P in bronzes, and 0.5-3.0% Mn in alloys of Cu and Ni. For industrial work the method can be simplified by using fewer points on the graphs, and dependable calibrating electrodes.
2847. BRIDGER, C. A. AND MARKS, G. W. Spectrochemical Determination of Nickel in Electrolytic Cobalt Using a Current-regulated Direct-current Arc. *U. S. Bur. Mines, Repts. Invest. No. 4198*, 7 pp. (1948). *C. A.*, 42, 4489g (1948).
- By use of an electronically controlled arc and the internal standard method of spectrochem. analysis, the following line pairs in the region 2900 to 3100 Å were found to be suitable for the detn. of Ni in Co: Ni λ 3134: Co λ 3132; Ni λ 3002: Co λ 3016; Ni λ 3012: Co λ 3022; and Ni λ 3003: Co λ 2995.
2848. BRINTZINGER, H. AND TITZMANN, R. Spectral-analytical Determination of Tungsten in Slags. *Z. anal. Chem.*, 128, 486-8 (1948). *C. A.*, 43, 3313b (May 10, 1949).
- For spectrographic work, the W line at 4008.8 Å is most sensitive but is hard to sep. from the Ti line at 4008.9 Å. For the detn., therefore, a spectrograph with wide dispersion is necessary and, for this reason a Zeiss 3-prism spectrograph with autocollimation-camera was used. Samples contg. bare traces to 2.1% W were tested and fairly satisfactory results obtained, e.g., 2.1% W instead of 2.20%.
2849. BRITSKE, M. E. AND VARSHAVSKAYA, L. N. Spectral Analysis of Ores and Industrial Products for Germanium and Molybdenum. *Izvest. Akad. Nauk S.S.S.R., Ser. Fiz.*, 12, 455-6 (1948). *C. A.*, 44, 3404b (1950).
- Detn. of Ge in Cu_2S contg. 0.0005-0.01% Ge is best based on the lines Ge 2709, Cu 2768 Å. The sensitivity increases with the current intensity of the arc, and is optimum at 17 amps., electrode gap 10 mm., slit 0.04 mm., exposure 2.5 min. The mean square error in several hundreds of detns. was 10-15%. Detn. of Mo, by the line pair Mo 3132, Cu 3128 Å, in a condensed 12 kv. spark, has a sensitivity of 0.001%, mean square error 7.5-8%.
2850. BROWN, J. G., LILLELAND, O., AND JACKSON, R. K. Determination of Calcium and Magnesium in Leaves Using Flame Methods and a Quartz Spectrophotometer. *Proc. Am. Soc. Hort. Sci.*, 52, 1-6 (1948). *C. A.*, 43, 9172i (1949).
- By use of a Beckman quartz spectrophotometer and a flame attachment manufd. by the National Tech. Labs. and appropriate standards contg. some of the interfering elements known to be present in the leaf samples quite accurate results were obtained. In 50 comparisons of Ca analyses the standard deviation of the photometric method from the chem. method was $2.9 \pm 2.08\%$, and for 50 analyses for Mg (all over 0.5%) $3.8 \pm 2.9\%$.
2851. BRUCELLE, G. Accuracy of Analytical Results in Steel Analysis. *Congr. groupe. avance. method. anal. spectrograph. produits mét.*, 9, 55-7 (1948). *C. A.*, 43, 2546c (1949).
- Spectrographic results in detg. Mn, Ni, Cr, Mo, V, and W in steel are likely to vary from 10 to 100% of the truth.
2852. BRUCELLE, G. The Feasibility of Interchanging Equipment in Spectrochemical Analysis. *Congr. groupe. avance. method. anal. spectrograph. produits mét.*, 10, 47-54 (1948). *C. A.*, 43, 5695c (1949).
- The app. understudy included 2 Zeiss-type Qu24 Quartz Cornu Spectrographs and 2 Feussner, one Beaudouin, and one Durr (type France) spark sources. Steel samples were sparked against a counterelectrode of Al, and were analyzed for Si, Mn, Ni, Cr, Mo, and V.

No significant changes in the analytical curves were detected when the spectrographs or the 2 Feussner sources were interchanged. Shifts and changes in the slope of the analytical curves were observed when the 3 source types were interchanged. Oscillographic studies of the sparks showed significant differences in the parasitic oscillations generated by the 3 sources.

2853. BRYAN, F. R. AND NAHSTOLL, G. A.
An Industrial Application of Geiger-Müller Counters to the Analysis of Phosphorus in Steels.

J. Optical Soc. Am., **38**, 510-17 (1948).

C. A., **42**, 5796b (1948).

The P content (0.005-0.20%) of steels is detd. by means of a Littrow quartz spectrograph equipped with Geiger-Müller photoelectron counter tubes. Emphasis is placed on operation and maintenance procedures for open-hearth and foundry furnace control. Arc excitation, which is essential for sensitivity and resolution of the P line from a nearby Cu line, introduces variables requiring close regulation. The temp. of the spectrograph must be maintained at nearly a const. value to prevent the shifting of spectral lines at the focal plane of the instrument. Each detn. requires about 1 min. after the sample has been prepd. and loaded, and accuracies are comparable to routine chem. results.

2854. BURKHARDT, C.

Spectrographic Methods and Their Standardization in the Klus Factory (Swiss).

Congr. groupe. avance. method. anal. spectrograph. produits met., **9**, 59-64 (1948).

C. A., **43**, 2539h (1949).

2855. BURKHARDT, C.

Spectrographic Analysis of Steels by Means of Auxiliary Electrodes.

Congr. groupe. avance. method. anal. spectrograph. produits met., **9**, 115-20 (1948).

C. A., **43**, 2546d (1949).

The method requires the use of the specimen as a plane surface.

2856. BUYANOV, N. V.

Spectral Analysis of Ores and Slags in an Alternating-current Arc.

Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., **12**, 439-43 (1948).

C. A., **44**, 3835a (1950).

In V ores and slags, V_2O_5 (0.7-1.6%) is detd. by the line pair V 3110.71-Ni 3107.71 Å; V_2O_5 (2.0-15.0%) by V 3110.71-Ni 3114.12; CaO (1.4-6.0%) by Ca 3179.33-Ni 3145.72; Al_2O_3 (2.0-10.0%) by Al 3082.16-Ni 3080.76; MgO (1.0-6.0%) by Mg 2782.97-Ni 2805.08; FeO (1.5-10.0%) by Fe 3047.60-Co 3044.00; Fe (20.0-40.0%) by Fe 3083.74-Ni 3099.12; SiO_2 (12.0-25.0%) by Si 2881.58-Ni 2821.29. In Cr slags, Cr_2O_3 (5.0-55.0%) by Cr 3124.98-

Ni 3114.12; Al_2O_3 (5.0-20.0%) by Al 3082.16-Ni 3080.76; Fe_2O_3 (1.5-8.0%) by Fe 3047.60-Ni 3045.00; CaO (2.0-5.0%) by Ca 3179.33-Ni 3145.72; SiO_2 (20.0-40.0%) by Si 2881.58-Ni 2821.29; MgO (10.0-20.0%) by MgO 2782.97-Ni 2805.08 Å. The accuracy of the detns. is, in V slags, V_2O_5 4.0, FeO 1.8, SiO_2 7.3, Al_2O_3 5.6, CaO 2.9, MgO 1.9%; in V ores, 7.0, 4.2, —, 3.5, 3.9, —; in Cr slags, Cr_2O_3 3.1, Fe_2O_3 3.3, SiO_2 2.7, Al_2O_3 4.7, CaO 5.0, MgO 2.0%.

2857. BUYANOV, N. V.

Spectral Analysis of Slags.

Zavodskaya Lab., **14**, 565-70 (1948).

C. A., **43**, 6541d (1949).

Full details are given for the spectroscopic examn. of finely powd. slag.

2858. BYRT, J.

Symposium on Recent Advances in Physical Metallurgy. IV. Physical Apparatus for Metallurgical Measurements.

(3) Spectrography.

Australasian Engr., June, 1948, 79-87.

Practical aspects of industrial spectrographic analysis are described under the headings: (a) sampling, (b) light sources, (c) optical systems, (d) recording of spectra, and applications.

2859. CARLSSON, C. G.

Calcium in Steel.

Jernkontorets Ann., **132**, 221-36 (1948).

C. A., **42**, 7196i (1948).

A spectrographic method is described for detg. Ca in steel. The soln. was evapd. on C electrodes, and an interrupted d.-c. arc was used for the excitation. Addn. of 10% K as K_2CO_3 increased the sensitivity 10 times, making it possible to det. 8 γ Ca on the electrode in the presence of 4 mg. Fe, and by extrapolation 1 ppm. By dissolving the steel in HCl or HNO_3 , the acid-sol. Ca was detd., and insol. Ca was detd. by decomp. the residue by fusion with K_2CO_3 . Total Ca was detd. by adding HF after the steel had been dissolved in HCl. In one steel, to which large quantities of CaSi, had been added for deoxidation, the Ca content was 0.0036%, but in all other samples it was less than 0.001%, and was probably present as nonmetallic inclusions. Mg was also detd. in a few samples, but very low values were found.

2860. CARLSSON, C. G.

Calculating Boards in Quantitative Spectrochemical Analysis.

Jernkontorets Ann., **132**, 467-84 (1948).

C. A., **43**, 1679d (1949).

A survey is given of the principles of some different types of calcg. boards of plate calibration by means of Fe lines.

2861. (No reference—error in numbering references)

2862. CASTRO, R. AND PHÉLINE, J. M.

Spectrographic Determination of Alumina in Residues of Metallic Oxides. Application to the Determination of Oxygen in Special Steels.

Spectrochim. Acta, 3, 379-88 (1948).

C. A., 43, 2546g (1949).

To est. Al_2O_3 in steel, the calcined residue from a HCl soln. of the metal is fused with $K_2S_2O_7$ and $CoSO_4$ is added to the aq. soln. This soln. is sparked on Cu electrodes, by using a spark source without a synchronous interrupter, and the Al lines compared with those of Co. The O content of the steel can sometimes be estd. from the alumina figure obtained in this way.

2863. CAVE, G. C. B.

Magnetic Stabilizer for Direct-current Arcs in Spectroscopy.

Anal. Chem., 20, 817-21 (1948).

C. A., 42, 8538g (1948).

A magnetic stabilizer is described which eliminates wandering of the central portion of a d.-c. arc used in spectrochem. analysis. Two phototubes are placed at the 2 vertical edges of an image of the arc; each phototube is connected through an amplifier to one of 2 coils of an electromagnet placed beyond the arc but along its optic axis. Sideways wandering of the arc illuminates the phototubes unequally, thereby producing a magnetic field which recenters the arc. Statistical analysis of tests for reproducibility on samples of powd. rock showed that in most instances the device improved the precision of analysis.

2864. CHEVALIER, A.

Presence of Magnesium and Potassium in Rain Water and Collection of Atmospheric Mineral-dust Particles by Trees.

Rev. intern. botan. appl. et arg. trop., 28, 170-2 (1948).

C. A., 46, 3337g (1952).

2865. CHOLAK, J. AND HUBBARD, D. M.

Spectrographic Determination of Beryllium in Biological Material and in Air.

Anal. Chem., 20, 73-6 (1948).

C. A., 42, 2300b (1948).

A spectrographic method has been developed for the detection of as little as 0.25 γ of Be in biol. material and in air. Details were given for the analysis of fresh urine without ashing and for a general wet-ashing procedure. The recommended procedure consisted of ashing samples with H_2SO_4 , HNO_3 , and $HClO_4$, pptg. $Be_3(PO_4)_2$, and dissolving this in an acid spectroscopic buffer soln. and the emission spectra photographed. The H and D curves were obtained for the Be line at 2348.6 Å and the Ti line at 2379.7 Å.

The av. sepn. between 2 curves at const blackening ($T \approx 0.5$) was read from a calibration curve prepd. from known amts. of Be. The presence of Fe did not increase the sensitivity of analysis and caused error when the amt. of Be was small.

2866. CHOLAK, J. AND HUBBARD, D. M.

Spectrochemical Determination of Beryllium; Increased Sensitivity of Detection in the Cathode Layer.

Anal. Chem., 20, 970-2 (1948).

C. A., 43, 3310b (1949).

The method previously described (*C. A.*, 42, 2300b) is modified to take advantage of the increased sensitivity of the cathode-layer procedure (cf. Mannkopff and Peters, *C. A.*, 25, 5110). The method is sensitive to 0.001 γ of Be in the arc; as little as 0.00025 γ can be detected in unweakened spectra. The most useful anal. range, by using the Be line at 2348.6 Å, extends from 0.005 to 0.30 γ per ml. of prepd. soln. The earlier method supplements the present one in the range 0.2 to 2 γ per ml., and a sep. working curve for the line pair Be 2650.8 and Ti 2580.2 Å is used for the range 2 to 30 γ per ml. The extreme difficulty of avoiding contamination at the lower concns. is emphasized.

2867. CLAUSEN, C. J., JR.

Aluminum-alloy Control with the Quantometer.

Western Metals, 6, No. 5, 26-9 (1948).

C. A., 42, 5396h (1948).

The Quantometer permits rigid control of chem. compn. of the alloy before it is poured. It can det. the quant. compn. of a prepd. sample in about 30 sec. It is essentially a direct-reading spectrometer, consisting of 3 units, a high-intensity source, a spectrometer contg. 12 light receivers, and a recording console with a recorder for each receiver. The excitation source consists of a high-voltage spark unit and a multisource unit, which permit a variety of discharges from spark-like to arc-like. The grating spectrometer has 12 photomultiplier receivers, mounted on tracks, each being adjusted to receive light from a single spectrum line of each of the elements to be detd. These receivers can be moved and adjusted to pick up the most desirable line of that particular element in the spectrum. The small amt. of current generated by a receiver is amplified to drive a magnetic counter. The counters drive revolving tapes, and the percentage compn. of as many as 12 elements, including the base metal, is brought about simultaneously when the analytical cycle of approx. half a min. is completed. The compn. of the alloy is read directly in percentage on precalibrated scales. The photographic error and the time-consuming process of measuring the d. of the spectrum lines on film are eliminated.

2868. CLAYTON, H. R.

Analytical Emission Spectrography.

Ann. Repts. Progress Chem. (Chem. Soc., London), 45, 316-26 (1948).

A general review of photographic and photoelectric emission spectroscopic analysis. 66 references.

2869. CLAYTON, H. R.

Rapid Method of Spectrographic Analysis.

J. Soc. Chem. Ind. (London), 67, 270-3 (1948).*C. A.*, 43, 2114f (1949).

A process was developed to complete spectrographic analyses in about 10 min. when speed was more important than great accuracy or permanence of photograph. This speed was attained by processing the photographic plates in ultra-fast developing and fixing solns., washing only 10 sec., and drying in an oven. Thin emulsions dried in 18 sec., thicker in 21 sec. A single analysis was finished in 8.5 min. with an error of $\pm 4\%$ with fast photographic plates or in 9.5 min. with an error of $\pm 3\%$ with slower plates. Duplicate detns. added 2 min. to each of these times but reduced the error appreciably. The method was developed for use in the rapid analysis of molten alloys.

2870. COHUR, P.

The Present State of Spectrochemical Analysis of Metals in America.

Congr. groupe. avance. méthod. anal. spectrograph. produits mét., 10, 37-46 (1948)
C. A., 43, 5694i (1949).

A survey. Subjects discussed include spectrographs, light sources, microphotometers, plate calibration, and direct-reading photometric instruments.

2871. COHUR, P. AND HANS, A.

Results Obtained with the Applied Research Laboratories (A.R.L.) Installation in Steel Determinations.

Congr. groupe. avance. méthod. anal. spectrograph. produits mét., 9, 43-8 (1948).
C. A., 43, 2546d (1949).

A Multisource and spectrograph built by A.R.L. are used to det. Ni, Cr, Mn, Si, Mo, Cu, and Sn in steel.

2872. COWAN, R. D. AND DIEKE, G. H.

Self-absorption of Spectrum Lines.

Revs. Modern Phys., 20, 418-55 (1948).
C. A., 42, 5340f (1948).

The intensities of spectrum lines are of great importance in the detn. of transition probabilities of atoms and mols., and of the phys. nature of radiating gases and vapors, and in quant. spectrochem. analysis. A derivation is given of the formula for the intensity of a line as modified by the absorption

of atoms of the same kind as the emitting atom. This formula is adapted to fit: (1) extended sources such as flames and discharge tubes in which excitation is uniform; (2) arcs and other sources in which emitting and absorbing atoms are spatially sepd.; (3) various nonhomogeneous sources. An important factor in this formula is the distribution function that det. the line-shape in the various kinds of source. Working-curves for spectrochem. analysis, which give the intensity of a line of an element as a function of its concn. in an alloy, must take into consideration the various conditions of self-absorption in the source, and are found to vary from a straight line for the case of no self-absorption to one strongly inflected away from it for the case in which the concn. of the atoms under test becomes large enough for a Doppler distribution to prevail. Before satisfactory comparison can be made of exptl. with theoretical line intensities the effects of total nos. of emitting atoms in the source, their transition probabilities, and width of spectrograph slit must be evaluated. The best methods for detg. the line-shape for no absorption, the absorption parameter, and the excitation function, from measured self-absorptions, are described.

2873. DANKO, A. W. AND WIENER, G. W.

Solders and babbitts. Routine spectrographic analysis.

Anal. Chem., 20, 1178-82 (1948).*C. A.*, 43, 3314i (May 10, 1949).

Details are given for detg. small quantities of Cu, Sb, Pb, and Sn by a spark spectroscopic method and the results of numerous analyses are tabulated. The method is rapid and sufficiently accurate for the routine examn. of solders and babbitts.

2874. DIEKE, G. H.

Short-period Phenomena in Light Sources.

Am. Soc. Testing Materials, Symposium on Spectroscopic Light Sources, *Spec. Tech. Pub. No. 76*, 37-59 (1948).*C. A.*, 43, 6083b (1949).

A discussion of methods used in studies of 3 types of light sources for spectral analysis—gas discharges, arcs, and sparks—together with causes and possible remedies of residual errors obtained during exposures over long time intervals. The theory of the 3 different sources is summarized. Intensity fluctuations observed with the aid of a cathode-ray oscillograph are discussed. In the gas discharge, intensity fluctuations depend on the pressure, the current, the nature of the gas, and the part of the tube where the intensity is observed. In the d.-c. arc, the most suitable spectrographic light source, the fluctuations, when not accompanied by voltage and current fluctuations (which can be controlled), are caused by the fact that the

arc wanders over the surface of the electrodes, so that it no longer fills the aperture satisfactorily, or that it causes the intensity of the spectrum to decrease. In the elec. spark, the theory of which resembles that of the gas discharge, the intensity depends upon the spot in the arc gap where it is observed, the nature of the electrodes, the presence of an air stream on the gap, lateral diffusion of the vapor from the iron electrodes, and gradual decrease of excitation.

2875. DRUTSKAYA, L. V.

Spectrographic Determination of Silicon and Iron in Silumin.

Zavodskaya Lab., **14**, 248-9 (1948).

C. A., **43**, 967c (1949).

D. uses transformer step 4 (Feussner circuit), capacitance 3000 cm.; self inductance, 15 turns of 1.5-mm. wire spaced 1 cm. apart on an 85-mm. (diam.) cylinder; spark gap 3 mm.; circular intermediate diaphragm; 40 sec. pre-spark, 60 sec. spark; slit width 30 μ ; electrodes of flat-topped cylinders, 5-mm. diam.; Al 2575 and Fe 2749 are compared with Si 2528.

2876. DRUTSKAYA, L. V.

Determination of Iron, Silicon, Copper, and Zinc in Aluminum by the Spectral Method.

Zavodskaya Lab., **14**, 571-5 (1948).

C. A., **43**, 6538h (1949).

A Zeiss spectrograph Q-24 and Feussner spark generator were used; the scale for the Zeiss microphotometer was graduated in logarithmic instead of in mm. units. Three standard samples were used for each detn. and 2 photographs were made of the standards and samples on each plate. For a content of Fe or Si over 1%, 3 photographs were taken of the standards and samples. By using a simple sparking arrangement and switching out the self induction coil, it was possible to reduce the sparking time for Fe and Si to 20 sec. and the exposure to 20-30 sec., depending upon the grade of the diapos. plates. For Fe concns. of 0.05-0.10, 0.10-1.20, and 1.00-2.0% the lines selected were Fe 2599 and Al 2669, Fe 2749 and Al 2652, and Fe 2743 and Al 2652, resp. For Si concns. 0.05-0.12, of 0.10-1.00, and 1.00-3.00% the lines selected were Si 2516 and Al 2669, Si 2516 and Al 2652 and Si 2528 and Al 2652, resp. For 0.001-0.010% Cu the lines were Cu 3248 and Al 3060; for 0.01-0.10% Zn the lines were Zn 2558 and Al 2460.

2877. DRUTSKAYA, L. V.

The Spectroscopic Laboratory of the Ural Aluminum Works.

Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., **12**, 453-4 (1948).

C. A., **44**, 3835f (1950).

The difficult problem of detg. 0.02-0.04% Zn in Al was solved by the use of a condensed spark with a generator capacity of 7800 cm., self-induction 840,000 cm., 12 kv. The analytical lines used for simultaneous detn. of Fe, Si, Cu, and Zn, are Al 3060, Si 2882, Fe 3274, Zn 3345 Å. Ca in electrolytic baths is detd., in the fused electrolyte, by the lines Ca 3179, Al 3082 Å.

2878. DURR, R.

Report Concerning Experiments on the Spark Generator Constructed for Spectrography in the Research Laboratory of Ugine Steel.

Group. Avanc. Mth. Spectr. VII Congress, 79-85 (1948).

Spectrochim. Acta, **4**, 186 (1950) (an abstract).

2879. EASTMOND, E. J. AND WILLIAMS, B. E.
Wide Range Analysis for Zinc Using Spectrographic Line Widths.

J. Optical Soc. Am., **38**, 800-3 (1948).

C. A., **42**, 8705f (1948).

A spectrographic method has been developed for detn. of zinc in biol. ashes by use of line width as a concn. index. Synthetic standards and analytical samples in the form of sulfates, are mixed with a K_2SO_4 -graphite buffer contg. Ba and Cd as internal controls. Samples are excited in a d.-c. arc and spectra recorded with a Littrow quartz spectrograph. The contour of Zn 2138 Å is recorded with a recording microphotometer and the width detd. at the max. d. of the control lines Ba 2255 Å or Cd 2288 Å. A plot of the log of this width vs. log of Zn concn. prep'd. from standard samples contg. 0.004-10% Zn serves as an analytical curve. Results detd. by ordinary d. measurements have been compared with those from width measurements. Although the 2 methods show comparable reproducibility of repeated exposures at the lower limit of the analysis range, the width method is more precise at higher ranges and has proved applicable even at concns. where the line-d. method is limited by self-reversal and low photographic-plate contrast. Concns. as high as 10% have been detd., which indicates possible application of such a method to the estn. of major constituents in biol. ashes or inorg. powders.

2880. EFENDIEV, F. M.

Influence of the Thickness of the Layer of Liquid on the Intensity of Spectral Lines Excited from the Solution.

Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., **12**, 471-4 (1948).

C. A., **44**, 3790g (1950).

The intensities were detd. with one electrode of a 10-kv. arc (20-30 milliamp.) immersed in the soln. of the salt, with its end

kept just underneath and at an adjustable distance from the liquid surface; the thickness of the liquid layer supported by the electrode was thus kept const. at 0.1, 0.5, 1.0, 2.0, or 3.0 mm. The salts of the following elements (concn. in % in parentheses) and the following spectral lines were investigated: Cu (0.005) 3247.54, 3273.96; Co (0.1) 3543.5, 3405.1, 2519.8; Cu (0.0001) 3247.54; Sb (0.1) 2528.5, 2598.06, 2877.9, 3029.8; Au (0.00002) 2675.95; Ag (0.0001) 3280.68; Hg (0.001) 2536.52; Te (0.01) 2385.7; B (0.05) 2497.73; Ru (0.05) 3498.95; Cr (0.1) 3593.5; Cs (1×10^{-4} - 1×10^{-4}) 4555.35; Ba (1×10^{-4} - 1×10^{-4}) 4554.05. In all cases, the intensities increase with decreasing thickness of the liquid layer, and very strongly so between 0.5 and 0.1 mm. It follows that when a bulk liquid is used as electrode, the concn. of excited atoms in the light source is very much lower than with a thin liquid layer supported by an electrode.

2881. ENNS, J. H.

Stabilized Control Gap for Spark Spectroscopes.

U. S. Patent 2,456,116, December 14, 1948. *Spectrochim. Acta*, 4, 256 (1950).

The air-interrupter described in this patent is a control gap, which when placed in the discharge circuit of a spark source controls both the condenser breakdown voltage and the number of discharges per unit of time. Likewise it is an essential feature of the spark initiated alternating current arc source (Enns and Wolfe, *J. Opt. Soc. Am.*, 39, 298 (1949)). Constancy of breakdown voltage is achieved by blowing a turbulent-free air stream from one or two orifices across the tips of the interrupter electrodes. The breakdown voltage is continuously variable from about 12,000 to 35,000 v. in the form of a front panel dial adjust. This adjustment can be made while the source is in operation so that resetting to predetermined spark- or spark-initiated arc source parameters is accurate and convenient.

2882. ENNS, J. H. AND WOLFE, R. A.

Study of the Controlled Spectrographic Light Source.

Am. Soc. Testing Materials, Symposium on Spectroscopic Light Sources, *Spec. Tech. Pub. No. 76*, 12-24 (1948).

C. A., 43, 6006i (1949).

The stability of spectrographic spark sources was investigated when controlled by the synchronous and the auxiliary air-gap interrupter, observations being made with a pickup whose output was recorded with the aid of an oscilloscope. When high-concn. Mg alloy electrodes are used instead of the usual W ones, the air-gap interrupter renders as stable operation, even at one spark per half cycle, as does the synchronous interrupter.

Peak line intensities observed with a two-gun oscilloscope showed the existence of a correlation between total transient energy and spectrum line intensity. The fluctuation in ratio between two lines is much less for pointed than for flat electrodes and is primarily affected by the energy input into the gap. Graphs are included to show the trend of events, plotted from spark-to-spark data obtained with a moving film camera.

2883. ENYEDI, B.

Availability of Photosensitive Materials in Ultraviolet Spectrum Analysis.

Magyar Kem. Lapja, 3, 370-1 (1948).

C. A., 43, 2114e (1949).

Lab. expts. showed that photosensitive papers with a glossy surface and a hard emulsion are well suited for wavelengths 4500-2300 Å.

2884. FASSEL, V. A. AND WILHELM, H. A.

The Quantitative Spectrographic Analysis of the Rare Earth Elements. I. Determination of Samarium in Neodymium. II. Determination of Europium in Samarium.

J. Optical Soc. Am., 38, 518-26 (1948).

C. A., 42, 5795f (1948).

Spectrographic methods applicable to the detn. of small amts. of rare earth impurities in other rare earths are described. The specific examples discussed are the detn. of Sm in Nd and of Eu in Sm. The procedures involve the high current d-c. arc excitation of rare earth oxide-graphite mixts. Selected lines of the major rare earth constituent are used as internal standards. Studies on the variation of the analytical intensity ratio during excitation and the effect of large changes in arc current, percentage of graphite, and wt. of sample charge on the intensity ratio values are included.

2885. FILIMONOV, L. N.

Effects of Sparking and the Mutual Influence of Elements in Spectral Analysis.

Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., 12, 402-11 (1948).

C. A., 44, 3833h (1950).

As a result of the action of the spark on the surface of the electrodes, the relative intensities of a given analytical line pair change with the length of the sparking. Exptl. curves of such changes, as a function of the length of time of sparking, are of 2 distinct types. One is illustrated by the curve of Mn, line pair Mn II 2576.1-Fe 2577.9 Å in a heat resistant steel; in air, the relative intensity ΔS first increases with time, passes through a max. (between 5 and 10 sec.), then falls and levels off. The 2nd type is represented by Ni in a 15% Ni steel, line pair Ni I 3566-Fe 3565 Å; here ΔS remains const. for about 20 sec., then

falls to a min., rises again, and levels off. The 1st type is encountered with elements more readily oxidizable than the main constituent of the alloy, the 2nd, with elements less subject to oxidation. The variation of ΔS is due to formation of superficial oxide films of varying compn., other than the compn. of the alloy, as a result of reduction of oxides by other metals. It was found that the emitted atoms are supplied mainly by the oxide film on the surface of the electrode. That film, in the first stages of the sparking, is always enriched in the more readily oxidizable component, which results in either a max. or a min.; on further prolonged sparking, this process is reversed. In the steady stage, the surface becomes covered with droplets of fused oxides. The Mn content of a stainless steel, detd. against an Fe line, was found, after a one-min. preliminary sparking, 100–300% too high; 22 at. % Si gave, under the same conditions, a Mn content too high by 600–1000%, whereas 15 at. % Ni lowered the result by 20%. Correspondingly, the curve of the increment of ΔS of Mn, due to the presence of the 3rd element, as a function of the length of time of sparking, passes through a max. in the presence of 15 at. % Cr, and through a min. with 15 at. % Ni.

2886. FISHER, A. W. AND WARREN, W. B.
Spectrograph Equipped with Photoelectric Measuring Means.
U. S. Patent 2,436,104, Feb. 17, 1948.

This patent, filed May 11, 1944, claims the combination, in a spectrograph for analytical purposes, of the means for exciting a sample, dispersing the light to form a spectrum, slits for isolating spectral lines, and for each slit, a photocell, an amplifier, an integrator, and a counter. The circuits provide for measuring the energy output of each tube until a predetermined level is reached on one tube whereupon the circuits are rendered inoperative.

2887. FREZE, N. A.
A Spectroscopic Method for the Semiquantitative Determination of Small Quantities of Silver.
Zavodskaya Lab., 14, 249 (1948).
C. A., 43, 968c (1949).

The Ag and accompanying metals are electroplated onto the polished end of an enameled 0.7-mm. Cu wire, which is then sparked. The time taken for Ag 5465.4 to disappear is then noted.

2888. FURMAN, N. H.
Analytical Work in the Manhattan District Project.
Chem. Eng. News, 26, 2490–2 (1948).
C. A., 42, 7649g (1948).

The chief concern of the work was the analysis and detn. of U in the presence of other elements. So many new ideas were made

practical that the methods will eventually be published in a book and elsewhere. With the spectroscope, it was found that the addn. of 2% Ga_2O_3 causes other less volatile compds. or elements to distil in the arc and aids in the detn. of 33 elements by their spectral lines. Many new colorimetric tests for U were developed. In estg. the impurities present in purified U compds. it was found advantageous to deposit small quantities of various metals by electrolysis in a cathode of Hg. After distg. off the Hg, the metals could be detd. with the polarograph. Many other new ideas were adopted in gravimetric, volumetric, and gasometric work.

2889. FÜRTH, R. AND OLIPHANT, W. D.
The Fürth Microphotometer and Its Application in Physics.
J. Sci. Instrum., 25, 289–94 (1948).

Details of construction and illustrations of oscillograph records are given. The scanning device is a microscope objective mounted on a tuning fork, maintained in vibration by a simple valve circuit. The amplified current from an electron multiplier produces an instantaneous oscillograph record of the density variations on a photographic plate. The resolving power is adequate for the majority of practical applications, e. g., spectrographic analysis.

2890. GANESAN, A. S.
Presence of Gallium in Micaceous Schists.
Current Sci. (India), 17, 87–8 (1948).
C. A., 42, 5387d (1948).

Spectroscopic examn. using a 5-ft. grating and carbon electrodes indicates Ga in schists assocd. with Mn ores from the Kandri and Mansar mines in the Nagpur district of India, in mica from Korhadi, and in bauxite ores from the Central Provinces. The mean wavelength of the Ga line is $4172.07 \pm 0.3 \text{ \AA}$ (a letter to the editor).

2891. GATTERER, A.
The Spectrochemistry of the Metalloids Fluorine, Chlorine, Bromine, Iodine, Sulfur, Selenium.
Spectrochim. Acta, 3, 214–32 (1948).
C. A., 42, 7650h (1948).

An easy and rapid method is described for detecting and detg. the metalloids: F, Cl, Br, I, S, and Se. A tube of high-melting glass is charged with a small quantity of sample (10 to 20 mg.) and thoroughly evacuated (less than 0.001 mm. Hg). The metalloid spectra are excited without electrodes in the high-frequency magnetic field of a coil with about 10 turns surrounding the sample-bearing tube. With this arrangement, ions of the listed metalloids, especially the halogens, are excited to intense spectral emission, which provides strong characteristic lines in the longer wave-length region (7000 to 4500

Å). These lines are well suited for detecting traces as well as for detns. The sensitivity limit is 0.001%, under favorable conditions, and detns. can be made down to 0.01% with an accuracy of 10%. Special advantages of the method are: (1) Small amts. of materials are used. (2) The sample is used in original form (powder) and in small quantities without any previous chem. treatment. (3) Since no metallic electrodes are used, clean work is possible even with the chemically active halogens. (4) The high sensitivity of one halogen is practically uninfluenced by the simultaneous presence of large amts. of the others.

2892. GHOSH, M. K. AND MAZUMDER, K. C. Spectrochemical Analysis of Bearing Alloys. *Indian J. Phys.*, 22, 409-12 (1948). *C. A.*, 44, 4371e (1950).

A spectrochemical method is described for detg. Sn (6.50-7.90%), Pb (3.0-3.65%), and Ni (0.70-1.0%) in Cu base bearing alloys. Good results are obtained.

2893. GIRSCHIG, R. Statistical Fluctuations in Spectrographic Analysis.

Congr. groupe. avance. méthod. anal. spectrograph. produits mét., 10, 159-71 (1948). *C. A.*, 43, 5693i (1949).

An analysis of the problem of assigning "confidence limits" to the mean of many observations, and the application of statistical theories to the evaluation of the fluctuations encountered in quant. spectro-chem. analysis.

2894. GIVORD, J. P.

Determination of Iron and Silicon in Aluminum by the Method of Internal Standardization.

Congr. groupe. avance. méthod. anal. spectrograph. produits mét., 9, 109-14 (1948). *C. A.*, 43, 2544f (1949).

The method is comparable to the external method (*C. A.*, 42, 3696c) in accuracy and takes 20% less time.

2894a. GOLDSCHMIDT, V. M., KREJCI-GRAF, K., AND WITTE, H.

Trace Metals in Sediments.

Nachr. Akad. Wiss. Göttingen, Math.-Physik. Kl., 1948, *Math.-Physik.-Chem. Abt.*, 35-52.

C. A., 47, 11095c (1953).

Results of spectrochem. detns. of NiO, Co₂O₃, Cr₂O₃, V₂O₅, MoO₃, and SnO₂ are presented for 269 samples of dacite, halite, limestone, sand, clay, ooze, sapropelite, coal, asphalt, ozocerite, oil, oil-field brine, soil, and recent org. matter of varying geol. age. Both nonbituminous and bituminous samples were investigated. The content of Ag, Au, Pt, Pd, and Os was detd. in 8 samples and of B₂O₃ in

4 samples. The origin of petroleum is discussed, and it is assumed that one may expect the same trace-element assemblage in the org. matter of source rocks and in the petroleum. Possibly the inorg. part of the source sediments also has a characteristic trace-element constitution. The following conclusions are based on the results of the spectrochem. analyses: The V/Cr ratio in ooze and peat usually is approx. 1, in sapropelites approx. 10 or higher. The V/Mo ratio in sapropelites usually is approx. 10, or higher, but is considerably lower in oozes. The enrichment of Ni in coal-bearing rocks is remarkable inasmuch as the coal paraffin contains very much less Ni than do the petroleum paraffin and ozocerite. The V and Ni content of petroleum and oxybitumens is highly variable and depends on the amt. of inorg. impurities. A particularly strong concn. of V takes place in asphaltization unless this process is caused by adjacent carbonate rocks. These and other results may be used for a geochem. characterization and classification of the source beds of petroleum.

2895. GUIBERTEAU, Y.

Spectrographic Analysis of Aluminum Alloys with the Aid of Electron-Multiplier Phototubes.

Congr. groupe. avance. méthod. anal. spectrograph. produits mét., 10, 95-7 (1948). *C. A.*, 43, 5700c (1949).

Ratios of phototube currents are registered by an automatic recorder. The 3944 Å Al line is used as a reference for the 2851 Å Mg, 2881 Å Si, 2949 Å Mn, and the 3021 Å Fe lines. Satisfactory stability and reproducibility are reported when lines used are from the same ionization state. Ratios involving both an arc and a spark line are shown to be very erratic.

2896. GULYAEVA, L.

Boron Content of Present-Day Sea Silts.

Doklady Akad. Nauk. S.S.S.R., 60, 833-5 (1948).

C. A., 42, 8544i (1948).

Detns. of the B sol. in 5% HCl in silts of northern inland seas showed contents from 2.91×10^{-3} to $10.7 \times 10^{-3}\%$, the highest content having been found in the fine-grained silt of the Karsk Sea. In sandy silts, the B content is lower, not exceeding $6.2 \times 10^{-3}\%$. In the clayey silts of southern seas (Azov, Caspian, etc.), the B contents are 5.24×10^{-3} to $6.2 \times 10^{-3}\%$. The limestone silt of the Caspian contains $1.52 \times 10^{-3}\%$ sol. B, the sandy silt of the Volga delta only $0.65 \times 10^{-3}\%$. In general, a higher B content in the waters of the basin corresponds to a higher content in the silt. Fine-grained silts are richer in sol. B than coarse-grained.

2897. HANAU, R. AND WOLFE, R. A.

The Use of Geiger-Müller Photoelectron Counters in the Spectrographic Analysis of Phosphorus in Steel.

J. Optical Soc. Am., **38**, 377-83 (1948).

C. A., **38**, 4093b (1948).

For routine quant. spectrographic analysis of P, with the line at 2136 Å, the Geiger-Müller photoelectron counter has certain advantages over both the photographic plate and the electron multiplier phototube. The construction of the counters and the methods of electrically shielding and mounting them on the Littrow spectrograph are described briefly. The adjustments of counter orientation, slit widths, and focus are discussed with reference to the analyses of Fe alloys where good resolution is necessary. Because of the absorption of radiation by quartz at low wavelengths, both abs. and relative intensities are dependent upon the position of the arc on the electrode surface. This effect, which results in appreciable error in the measured content of a sample, was studied photographically with Geiger-Müller counters, and several methods of reducing the effect are discussed. The effect of temp. changes of the dispersing prism on line position was investigated and a suitable method of control is mentioned. Preliminary consideration of this direct-reading method shows that it seems possible to reduce the various errors so that the source fluctuation is the controlling factor.

2898. HANNICK, A.

Use of the Applied Research Laboratories (A.R.L.) Installation to Determine Residual Elements in Thermal and Electrolytic Zincs.

Congr. groupe. avance. method. anal. spectrograph. produits mét., **9**, 49-52 (1948).

C. A., **43**, 2545i (1949).

Successful analyses of the zincs were obtained.

2899. HANSEN, G.

Multi-prism Spectrographs with Glass Optics by Carl Zeiss, Jena.

J. Optical Soc. Am., **38**, 759-66 (1948).

Spectrochim. Acta, **3**, 624 (1949).

The "G50" spectrograph made by Carl Zeiss consists of three identical prisms and a plane mirror. The total deviation of the prism system is 180° for the ray at minimum deviation. This spectrograph can be used in the range 3700 to 10,000 Å. There solving power for single passage of the rays is approximately 5000 at 10,000 Å, and for double passage of the rays 250,000 at 3700 Å.

2900. HARRISON, G. R., LORD, R. C., AND LOOFBOUROW, J. R.

Practical Spectroscopy. New York, Prentice-Hall Pub. Corp., 605 pp. (1948).

Reviewed in *Spectrochim. Acta*, **3**, 619-20 (1949).

This is a general textbook of spectroscopy covering the principles of importance to the fields of physics, chemistry, and biology, but without extensive treatment of applications of the methods described. Details are given on the selection, adjustment, and illumination of spectrographs. The general characteristics of a wide variety of light sources are described. One chapter is given to qualitative analysis and one to quantitative analysis. Tables of sensitive lines are included.

2901. HARTMANN, W. AND PRESCOTT, B. E.

The Spectrochemical Determination of Barium, Strontium, and Calcium.

J. Optical Soc. Am., **38**, 539-41 (1948).

C. A., **42**, 5794c (1948).

The procedure herein described was developed for the detn. of Ba, Sr, and Ca in mixts. of the carbonates. While the procedure is primarily designed for samples contg. 50-200 γ of these elements, it is also applicable to samples of greater wt. by dilg. to a proper working concn. Samples are dissolved in dil. HCl + AcOH; 500 γ Cu (as nitrate) is added to each, and the solns. are dild. to 1.0 ml. Aliquots of these solns. and of a graduated series of standards, similarly prepd., are pipetted to waterproofed graphite electrodes, dried, and excited in the a.-c. arc. The resulting spectra are recorded on the same plate and the detns. are made by the usual internal-standard technique.

2902. HASLER, M. F., HARVEY, C. E., AND BARLEY, JR., F. W.

The Spectrochemical Analysis of Cements and Other Mineral Products.

Am. Soc. Testing Materials, Proc., **48**, 944-58 (1948).

C. A., **44**, 3691i (1950).

A semiquant. method has been extended to cover materials of general interest to the cement industry, such as cement, limestone, clay, iron ore, and sand. A simple, reasonably accurate, d.-c. arc method, employing specially shaped electrodes, has been devised for the analysis of a group of elements in portland cement: Al, Mg, Fe, Mn, Ti, Na, and K. A more elaborate method employing briquets of cement mixed with graphite has been modified to minimize the effects of a variation of phys. and chem. forms in samples, and to increase the sensitivity of the K detn. The main problems of spectrochem. analysis of nonmetallic samples are discussed against the background of a study of the principal methods of analysis proposed to date for solid samples. Spectrochem. methods of semiquant. and quant. analysis are now available for use in the cement industry. These methods allow a six- to eight-fold increase in

speed of analysis and with Al, Na, and K, an appreciable increase in accuracy over wet chem. methods.

2903. HASLER, M. F., LINDHURST, R. W., AND KEMP, J. W.

The Quantometer, a Direct-reading Instrument for Spectrochemical Analysis.

J. Optical Soc. Am., **38**, 789-99 (1948).
C. A., **42**, 8538a (1948).

The Quantometer, a direct-reading instrument for spectrochem. analysis, is described. The spectrometer equipped with movable receivers is discussed from the standpoint of basic optical, mech., and elec. design. An arrangement of 4 bridges with 3 receivers on each allows up to 12 receivers to be moved and positioned so as to receive light from a great variety of line arrays in the spectrum range covered by the instrument. The limitations in this respect are presented for instruments utilizing 24,400 line per in. gratings and 36,600 line per in. gratings, both with a 1.5-m. radius of curvature. The basic elec. circuits and const. are given in detail for the receiver units, the low- and high-voltage power supplies, the sensitivity controls, and the recorders. The recording console is described especially with regard to the interchangeable panel method of direct reading, suitable for the analysis of a wide variety of alloys of the same base material. General operating methods are discussed in some detail. Adjusting and testing the instrument are explained and the precision of the unit as a light-measuring device is indicated.

2904. HAYCOCK, M. H. AND RUSSELL, L. R.
Spectrographic Determination of Potash in Rock Salt.

Trans. Can. Inst. Mining Met., **51** (Can. Mining Met. Bull. No. 433), 281-3 (1948).

C. A., **42**, 5375h (1948).

Synthetic solns. are prepd. by varying the quantities of NaCl and KCl in amts. which represent a range of 1-6% K in the sample. For concns. above 6%, a diln. factor of 4 is used, and the results are multiplied by this factor. The standard solns. are prepd. so that each 10 cc. contains 1 g. of combined KCl and NaCl; to each 10 cc. is added 1 cc. of stock CuCl_2 soln. as an internal standard. This soln. is prepd. by dissolving 1 g. of $\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$ in distd. H_2O and making up to 3 cc. The sample is prepd. by dissolving 1 g. of dried powder in distd. H_2O and making up to 10 cc., then adding 1 cc. of CuCl_2 soln. A microburet is used to add 0.02 cc. of both standard and sample solns. to the cups of prepd. graphite electrodes. Arcing is done immediately. The K concns. of samples are detd. by referring their log intensity ratios to log-intensity vs. K-concn. curves. The

electrode gap is 3 mm. The exposure is 15 sec. at 250 v. and 8 amp.

2905. HERMAN, H.

Spectrographic Determination of Columbium and of Tantalum.

Spectrochim. Acta, **3**, 389-96 (1948).

C. A., **43**, 2543g (1949).

The method described makes it possible to det. from 1 to 99% of Cb or Ta in samples contg. some Ti and W. The pentoxides sepd. by a simple chem. procedure are spectrographed on graphite electrodes in the d.-c. arc at 10 amp. A spectrograph of medium dispersion is used in combination with a step sector. Less than 0.02 g. of pentoxides is sufficient.

2906. HERMAN, J.

The Spectrograph and Polarograph.

Calif. J. Mines Geol., **43**, 379-409 (1948).

A discussion of the Applied Research Laboratories spectrograph and the Heyrovsky polarograph, and some applications in analytical work. The sensitivity of detection by the spectrograph and its use in preliminary analysis are emphasized.

2907. HERMAN, R. C. AND SILVERMAN, S.

A Cinema-spectrograph for Photographing Rapid Spectral Sequences.

J. Optical Soc. Am., **38**, 209-11 (1948).

C. A., **42**, 2520h (1948).

A simple spectrograph designed around a 16-mm. movie camera is described. The spectrograph was built for the purpose of obtaining spectrograms from light sources showing transient phenomena, in particular such light sources as the new types of rocket and jet combustion engines. The spectral range 3800 to 6500 Å is photographed with an av. dispersion of 200 Å mm. and a probable limit of about 200 frames/sec. for sources of brightness comparable to an acetylene flame. Spectrograms of an acetylene-oxygen flame showing the effect of varying the oxygen-fuel ratio illustrate the usefulness of this instrument.

2908. HÉROS, M.

Spectral Emission Analysis.

Chim. anal., **30**, 268-72 (1948).

C. A., **43**, 961c (1949).

In this first installment of a comprehensive review, the principles underlying spectral analysis are stated and details given concerning the source of light, its dispersion, method of reading the position of the spectral lines and estg. their d.

2909. HIRT, R. C. AND NACHTRIEB, N. H.

Spectrographic Determination of Rare Earth Elements in Uranium Compounds.

Anal. Chem., **20**, 1077-8 (1948).

C. A., **43**, 1684a (1949).

Seven rare earth elements were studied spectrographically to det. their wave lengths and sensitivities. To avoid interference from U lines, the U was removed by an ether extrn. of uranyl nitrate, the rare earth pptd. as a fluoride, and purified with NaOH. The spectrographic detn. was carried out by the Cu-spark method, with a Jarrell-Ash Wadsworth automatic spectrograph.

2910. HOOGLAND, P. L.

Methods for the Determination of Some Trace-elements in Biological Material.

Anal. Chim. Acta, 2, 831-8 (1948) (in English).

C. A., 43, 7998a (1949).

A review of qual. (spectral) and quant. methods for Al, As, B, Cu, F, Fe, Mn, Mo, and Zn in small amts. of material.

2911. HULDT, L.

A Spectroscopic Investigation of the Electric Arc and the Acetylene-air Flame with Special Regard to Their Application as Light Sources for Quantitative Spectral Analysis.

Almquist & Wiksells Boktryckeri A. B., Uppsala (1948). 77 pp., 19 illustrations. *Spectrochim. Acta*, 3, 632-3 (1949).

From intensity measurements of spectral lines the author undertakes to calculate the physical condition of the emitting light sources: electric arcs or acetylene flame. He starts with the established assumption that thermal equilibrium exists in these sources, and consequently the Boltzman distribution law, mass action law, and Saha ionization formula apply to the calculation. Intensity measurements result from photographic photometry and use of a calibrated tungsten-ribbon lamp. The temperature of the arc is determined from intensity ratios of atomic lines (Cu and Ba), and the flame temperature is calculated from reversal phenomena of the lines. The pressure of electron gas is obtained from the intensity ratios of arc and spark lines of the same element, and the partial pressure of the luminous gas column is derived from measurements of absolute intensities of the lines. The accuracy of the results is limited by the unavoidable errors in intensity measurements and by uncertainties of the atomic constants. Nevertheless, these results are of great importance to the practical spectrochemist because they show how the detectability and intensity ratio of analysis lines may be influenced by the presence of extraneous elements or by the addition of such (e. g. alkali salts).

2912. HULDT, L.

Spectroscopic Measurement of the Temperature and the Electron Pressure in the Carbon Arc.

Arkiv. Mat. Astron. Fysik, 36A, No. 3, 17 pp. (1948).

C. A., 43, 940g (1949).

A C arc was viewed end-on through a bored anode and its spectrum was photographed after the electrodes were satd. with chloride or nitrate solns. of Ba and Cu. Some spectrograms were also made after one or both electrodes had been soaked in a satd. soln. of NaCl. The temp. of the arc was detd. from measurements of intensities of Cu and Ba lines whose transition probabilities were known. Temps. of 4380 and 5260°K. were obtained from Ba and Cu lines, resp., but in the presence of Na these temps. are reduced to 3890 and 4580°K., resp. The partial pressure of free electrons was calcd. from measurements of the intensities of a Ba I and a Ba II line with the aid of the Saha formula for temp. ionization, the temp. having been detd. as described. Electron pressures of the order of 10^{-4} atm. and 10^{-4} atm. correspond to the Ba and Cu temps., resp. The differences between the Ba and Cu temps. are ascribed to inhomogeneities of the light source. The addn. of Na reduces the temp. and decreases the no. of ions relative to neutral atoms. If the temp. and electron pressure have been measured the change of line intensity caused by Na can be calcd. This is demonstrated for lines of Al, B, Ba, Ca, Fe, Mg, Si, and Sr present as impurities in the carbon electrodes.

2913. HUNTER, R. G.

Spectrographic Chemical Analysis.

W. Virginia Geol. and Econ. Survey, Rept. Invest. No. 5, 1-22 (1948).

C. A., 46, 10040f (1952).

Methods are described and their application is illustrated by analyses of limestones and coal ashes.

2914. INDICHENKO, L. N.

Spectral Analysis of Iron and Manganese Ores.

Doklady Akad. Nauk S.S.S.R., 59, 1157-9 (1948).

C. A., 42, 7112d (1948).

Distortions of the relative intensities of spectral lines of different elements owing to spattering of the ore in the ordinary carbon arc are avoided by the use of carbon electrodes with a crater up to 3 mm. in diam., 8-10 mm. deep, with 10-12 oblique channels of up to 1 mm. diam. drilled through the walls of the crater; the lower openings should end near the bottom of the crater, the upper channels at about 3-4 mm. below its rim. The material should be piled into the crater in such a way that the upper channels remain unobstructed. With such electrodes, Cb, Zr, and Ni lines in magnetite, hematite, and pyrite, and Co lines in pyrite, were about 2-3 times more intense than with the use of or-

inary carbon electrodes, and about 1.5-2.0 times more intense than with the method using mixts. of the ore with Na_2SO_4 .

2915. IRISH, P. R.

Spectrographic Analysis of Alumina in Silica Brick.

Open Hearth Steel (Proc. Conf. Am. Inst. Mining Met. Engrs.), 31, 143-51 (1948).
C. A., 43, 8112c (1949).

A sample of the brick in powd. form is fused with a mixt. contg. Na_2CO_3 49.75, borax 49.75, and Cb oxide 0.5% which acts as an internal standard. The fusion is carried out in a Pt crucible in an elec. furnace at 1100-1150° for 3 min. A spectrographic C is dipped into the molten flux. The flux adheres to the C; this forms an electrode tipped with the brick and the internal standard in soln. A detn. can be made in 30 min.

2916. JACQUINOT, P.

Optical Analysis of Photoelectric Spectrographs; the Influence of Aperture and Slit Width on the Luminosity and Resolution.

Congr. groupe. avance. méthod. anal. spectrograph. produits mét., 10, 79-86 (1948).
C. A., 43, 5233a (1949).

The problems of obtaining an optimum balance of resolving power and intensity in spectrographs adapted for use with phototubes are discussed. The max. resolving power attained without excessive loss of sensitivity is shown to be 90% of the intrinsic resolving power of the spectrograph.

2917. JAMES, C.

Spectroscopic Analysis of Alloy Steels.

J. Proc. Roy. Soc. N. S. Wales, 82, 75-8 (1948).
C. A., 44, 7713h (1950).

Rapid qual. analysis of alloy steels with the Spekter Steeloscope spectrocope is described. The visible spectra of 3 alloy steels are shown with enlargements of the anal. spectrum lines used. Alloy constituents identified were Cr, Mn, Mo, Ni, Ti, V, W.

2918. JEAN, M.

Experimental Methods and Rapid Calculation in Spectrographic Analysis.

Congr. groupe. avance. méthod. anal. spectrograph. produits mét., 9, 89-108 (1948).
C. A., 43, 2539e (1949).

A practical method of calcn. is described.

2919. JENSEN, D. P.

Microspectrochemistry of Aluminum Alloys.

Iron Age, 161, No. 2, 66-8 (1948).
C. A., 42, 1527i (1948).

A procedure for studying diffusion in clad

Al alloy sheet at thickness intervals of about 0.001 in., commencing within 0.001 in. of the surface, is described. The test spot is traversed in depth by machining increments of 0.001 in., and the sparking excitation is weak enough not to penetrate 0.001 in. in depth. A 1-sec. sparking, without prespark, with an excitation of 2 mf. capacitance, 50 microhenries inductance, and 0.4 ohm resistance, produced a max. crater depth of 0.00069 in. The superposed spectra from 30 such 1-sec. sparkings produce an adequate spectrogram for the accurate detn. of all elements present in Al alloys. This technique was used to study the diffusion in the heat-treatment of clad 75ST sheet, to det. whether a difference exists between 10 min. soln. time at 870°F. and 2.5 hr. soln. time at 920°F. (both in NaNO_3 and both followed by 24 hrs. aging at 250°F.). Negligible differences were found between these 2 treatments.

2920. KAISER, H.

Systematic Errors in the Evaluation of Spectrograms by Photographic Photometry.

Spectrochim. Acta, 3, 278-96 (1948).
C. A., 43, 2539g (1949).

A generalized scheme for the evaluation of spectra, and an application of the theory of density transformations, together lead to a general equation for systematic errors in the evaluation of d. measurements in spectrophotometry. From this equation one can deduce how the result of the evaluation is influenced by the curvature of the photographic characteristic curves, by differences in plate sensitivity and by erroneous values for the calibration marks. Many systematic errors can be allowed for in the calibration of an analytic procedure, so that the evaluation can be simplified. For line with a great wave-length interval, the evaluation must be performed with 2 characteristic curves. It is shown how this may be done without any calcn. by use of an Owens calcg. board.

2921. KAISER, H.

The Influence of Background on the Form of Spectrochemical Calibration Curves.

Spectrochim. Acta, 3, 297-319 (1948).
C. A., 43, 2539i (1949).

Spectrochem. calibration curves are strongly curved in the region of faint-line intensities, if the intensity of the spectrum background is not taken into consideration. If the background intensity is deducted then, in general, a straight-line calibration curve results. The equations for the (true) straight line and for the uncorrected calibration curve are set up. Each can be calcd. from the other. If the curvature of the calibration curve is not too pronounced, it can be replaced in limited concn. ranges by a straight line which approached it as closely as possible. The equa-

tions for the calcn. of these substituted straight lines are developed. It is shown that the true straight line and the calibration curve can with certain assumptions be calcd. from the substituted straight lines, and conversely. Thus it is possible from the data for a substituted straight line to obtain the calibration values for lower concn. ranges for which a simple extrapolation would lead to large systematic errors. For the systematic errors of analysis which arise through the use of a substituted straight line, a simple formula is given. From this is derived a graphic representation from which one can see whether or not a background correction is to be made, if the systematic errors in a definite concn. range are to be kept under a pre-established limit. The theory is illustrated by an exptl. example (detrn. of Mn in Al). In the appendix it is also shown what effect can be expected on the background correction in the supposition that all intensity ratios are calcd. with a false filter value. Even then the calibration curve is straightened by means of the background correction, although the corrected curve is not precisely a straight line.

2922. KAISER, H.

Status and Development of Spectrochemical Analysis (Emission Analysis).

Z. angew. Physik, 1, 35-45 (1948).

Spectrochim. Acta, 3, 258 (1948) (an abstract).

The development of spectrochemical analysis, especially during recent years, is reviewed with regard to (1) procedures and to (2) scientific and technical progress. Part (1) deals with qualitative and quantitative analyses, time and cost, analysis automats, and professional questions. Part (2) discusses the preparation of samples, the physics of light sources, construction of instruments, and the derivation of results.

2923. KAMADA, H. AND YASUDA, H.

Preparation and Analysis of Pure Copper.

J. Japan. Chem. (Kagaku no Ryōhiki), 2, 31 (1948).

C. A., 44, 1830g (1950).

Pure Cu was prepd. by electrolysis. The electrolyte was made ammoniacal and MnO_2 was formed. The impurities in the electrolyte were removed by occlusion in the MnO_2 , and the purified filtrate was electrolyzed. Cu obtained was melted in a vacuum. The impurities (Ag plus Au, Pb, Fe, As, Sb, Bi, S, and O) were detd. by spectral or colorimetric micro-methods after concg. by occlusion to MnO_2 . The purity aimed at was 99.99%; the impurities detd. were Fe 0.00022, Sb 0.000036, and Bi 0.000016%.

2924. KHEIFITS, A. L. AND CHEREZOVA, L. N.

Examination of Gold and Silver for Purity.

Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., 12, 462-3 (1948).

C. A., 44, 3836i (1950).

Impurities in a high-purity specimen of Au were detd. by spectral analysis of a known, less pure sample, dild. in a known proportion with the high-purity metal. The latter was thus found to be 99.998% pure, with Ag 0.0005, Cu 0.0005, Fe 0.0002, Ca 0.0002%, Si traces. A similar procedure was used for Ag.

2925. KHRSHANOVSKIĬ, S. A.

New Construction of Spectral Apparatus.

Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., 12, 482-8 (1948).

2926. KLER, M. M. AND REZVOVA, M. I.

Quantitative Spectrographic Determination of the Principal Constituents of Bauxite.

Zavodskaya Lab., 14, 1092-4 (1948).

C. A., 45, 4603b (1951).

Compress bauxite 1, pure graphite 5, pitch 0.3 and Co_3O_4 0.6 g. to a pellet under a total pressure of 5400 kg. Spark the pellet 2 min., with a graphite rod 5 mm. in diam. as the upper electrode. Use Co 3044 Å as the internal standard line.

2927. KOFOID, M. J.

Observations on Arc Discharges at Low Pressures.

J. Applied Phys., 19, 399-404 (1948).

C. A., 42, 6703e.

At pressures of 1-200 mm. Hg, short arcs burn with low apparent cathode c.d. The melting of the electrodes is then greatly reduced. This paper describes spectrographic tests to det. the presence of electrode material in the arc. It was found that in an arc of given current and length as the gas pressure was increased the amt. of cathode material suddenly increased, as indicated by spectral line intensity. The gap ranged from 1 to 18 mm., and the crest current was approx. 1300 amp. The arcs conc. near the center of magnetic cathodes but tend toward the periphery of nonmagnetic ones. Brass is the most resistant to surface melting and puddling.

2928. KOMAROVSKIĬ, A. G.

Influence of the Structure of the Alloy and of the Presence of a Third Element on the Determination of Manganese and of Chromium in Steels.

Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., 12, 422-28 (1948).

C. A., 44, 3837g (1950).

Spectroscopic detn. of Mn by the line pair Mn 2933.063-Fe 2730.74Å, and of Cr by the pair Cr 3128.7-Fe 3167.8 Å, is not affected by the thermal treatment of the iron, annealing

or quenching. With regard to the influence of addnl. elements, the detn. of Mn is sensitive to Ni, Cr, W, Mo, V, Si, and C. The calibration line, log of the ratio of intensities of the Mn and Fe lines, plotted against log concn. of Mn, is shifted upwards, parallel to itself, by Cr 2-7, W 4-20, Mo 0.2-1.5%; within these limits, all points lie on the same line. A still higher-lying line is obtained with Ni 2-25, Cr 7-18, W 2-7, Mo 0.4-7, V 0.2-1.5, Si 0.6-2, C 0.4-3%. With 8% Mn, up to 9% Ni have no effect on the calibration line. In low-alloy steels, up to Ni 5, Cr 6, W 4, Mo 2, V 1.5, Al 2, and Cu 0.3%, have no influence on the detn. of Mn. The spectroscopic detn. of Cr is unaffected by W 0.2-21, V 0.5-1.5, Mo 0.2-1.5%, and, in high-alloy steels with up to 25% Cr, by 2-27.5% Ni. In low-alloy steels, up to Ni 5, W 4, Mo 2, V 1.5, and Mn 1.5%, do not affect the detn. of Cr.

2929. KORITSKIĬ, V. G.

Influence of the Dimensions and of the Mass of the Sample on the Results of Spectral Analysis of Steels.

Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., 12, 429-31 (1948).

C. A., 44, 3842a (1950).

In a condensed spark, the difference ΔS of the optical d. of the analytical lines for Cr, Mn, Ni, etc., loses its constancy when the diam. of the steel cylinder falls below 9-10 mm. This effect is due to the fact that the diam. of the spark spot is about 9-10 mm., and consequently, the cross section of samples of a smaller diam. is not completely covered by the spot. Apart from the role of the cross section, the influence of the mass is detd. by differences of the temp., was demonstrated by detns. in which the samples were kept at a const. temp. The results, given in plots of ΔS against the temp., for the pairs Mn-Fe, Si-Fe, Ni-Fe, Cr-Fe, and Cu-Fe, show that the heating-up of samples of too small a mass (below 10-30 g.) introduces a systematic error in ΔS .

2930. KORITSKIĬ, V. G. AND EDNERAL, T. B.

Influence of the Mass and the Dimension of Samples on the Results of Spectral Analysis of Steels.

Zavodskaya Lab., 14, 558-65 (1948).

C. A., 43, 6540i (1949).

Decrease in diam. of samples from 25 to 5 mm. showed that below 9-10 mm. there is a systematic error in detg. Mn, Si, Cr, Ni, Cu, Mo, V, and W in steels. The effect was most pronounced for Mn and lowest for Cu and Ni. These errors occur because of interference with the sparking processes which take place in those cases when the area which is subjected to sparking becomes less than that of the so-called "spot of sparking." The extent of this spot depends upon the geometry of

the spark gap, grade of steel being analyzed, and also type and characteristics of the generator. Under established standard conditions the diam. of the "spot of sparking" varies from 9 mm. for low alloy steels to 12 mm. for stainless steels. A reduction in the mass of the samples from 250 to 10-30 g. did not affect the results noticeably but further decrease caused error. The limiting value of the mass depends upon the heat cond. capacity of the steel and differs somewhat for various elements; the greatest value of 30 g. was for Cr. Graphs of S as function of diam. and mass of samples are given.

2931. KOZLOVA, A. V. AND KORZH, P. D.

Spectral Determination of Chromium in Ferrochrome.

Zavodskaya Lab., 14, 1095-7 (1948).

C. A., 45, 4600e (1951).

The sample was prepd. and excited by the Sventitskii transfer technique (C. A., 42, 8695a), and the concn. of Cr detd. by persistence of the 5204-Å group of Cr lines in the analytical spark discharge. The amt. of material transferred during the transfer spark discharge depends on the length of this discharge, but not on the elec. parameters of the circuit.

2932. LALLEMAND, A.

Photoelectric Spectrographic Analysis.

Congr. groupe. avance. method. anal. spectrograph. produits mêt., 10, 91-3 (1948).

C. A., 43, 5693g (1949).

An electron multiplier phototube is mentioned in which the solid dynodes are replaced by wire grids. For a 6-stage multiplier operating at 120 v. per stage, a sensitivity of 80 μ amp./lumen, a dark current of 3.75×10^{-10} amp. and the equivalence of the dark current to a luminous input of 3.5×10^{-9} lumen are claimed. For a 12-stage tube, the characteristics are 66 μ amp./lumen, 1.3×10^{-8} amp. dark current with an equiv. illumination of 3×10^{-10} lumen. These phototubes are mounted behind the exit slit of a spectrograph. Each tube is adjusted to receive a spectrum line, and the ratio of line intensities is measured by using the output of two tubes, balancing one against the other by a potentiometric method.

2933. LANDERGREN, S.

On the Geochemistry of Mediterranean Sediments. Preliminary Report on the Distribution of Beryllium, Boron and the Ferrides in Three Cores from the Tyrhenian Sea.

Göteborgs Kungl. Vetenskaps-Vitterhets-samhälles Handl. Ser B, 5, No. 13 (6) 34-46 (1948).

Spectrochim. Acta, 4, 70 (1950).

A summary is given of the spectrographic

methods used. The ferrides (Ti, V, Mn, Fe, Co, Ni and Cr) and Be were estimated visually by means of the cathode layer carbon arc in combination with a step sector. Boron was detd. with an interrupted arc.

2934. LANDERGREN, S.

On the Geochemistry of Swedish Iron Ores and Associated Rocks. A Study on Iron-Ore Formation.

Sveriges Geol. Undersökn., Ser. C., Avhandl. och Uppsät., No. 496, Arsbok 42, No. 5, 182 pp. (1948) (in English).

C. A., 43, 5701b (1949).

A number of geochemically significant constituents (the ferrides: Ti, V, Cr, Mn Fe, Co, Ni; Li, Rb, Be, B, some lanthanides, Mo, W, Mg, K) were detd. in numerous Fe ores of Sweden, in Fe-bearing rocks, in rocks assocd. with the Fe ores, and in a no. of Fe ores from Great Britain, Ireland, Norway, Finland, Germany, France, Luxembourg, Italy, Spain, U.S.A., and U.S.S.R. Spectrochem. and chem. methods of analysis were used; an account is given of the spectrographic technique. The construction details of the Stålex spectrophotometer are discussed. The distribution of the major constituents in the analyzed material is treated statistically in order to demonstrate the geochem. principles involved in the partition of the elements between Fe ores and igneous rocks. The results are presented in tables and histograms giving the quartz ratio, degree of oxidation, and the $MgO:CaO$, $MgO:FeO$, $K_2O:Na_2O$, and $Mn:Fe$ ratios. The content of the minor constituents in the analyzed material is presented in numerous tables, the data being grouped according to geographical and geol. regions, element groups and classification of the samples.

2935. LANGSTROTH, G. O. AND ANDRYCHUK, D.

The Effect of Variations in the General Composition of Samples in Spectrographic Analysis.

Can. J. Research, 26A, No. 2, 39-49 (1948).

C. A., 42, 5372h (1948).

Cf. *C. A., 36, 3429¹.*

Variations caused by the addn. of extraneous substances on the intensity ratios of 86 spectral line pairs of 19 pairs of elements were studied as a function of the test elements, the nature of the extraneous substances, the line pair investigated, and the presence or absence of K acetate buffer. The variations bore no apparent relation to the relative ionization potentials or at. wts. of the test elements, nor to any phys. property of the added substances. In general, the variations were smaller for line pairs having most nearly equal excitation potentials. The addn. of a buffer usually, but not always, reduced the variations; reproducibility was higher with buffered sam-

ples. Operation of the discharge at const. current rather than min. breakdown voltage was found to be advantageous, but only with buffered samples. A condensed spark discharge was used in this investigation; doubling the capacity of the spark circuit had no effect. Illumination of the electrode with ultraviolet light had no effect other than producing a steadier discharge.

2936. LEDERLE, P.

Replacement of the Alkali Photocell by a Selenium Cell in the Apparatus of Schuhknecht-Waibel for Determining Potassium and Phosphoric Acid.

Z. Pflanzenernähr. Düngung u. Bodenk., 42, 45-7 (1948).

C. A., 43, 6871f (1949).

The replacement has the advantage that an auxiliary current source is unnecessary and the app. is independent of annoying current fluctuations. Cf. 2981.

2937. LEUTWEIN, F.

Spectrographic Method of Analysis for Metallurgical, Mining, and Refining Industries.

Arch. Metallkunde, 2, 75-82 (1948).

C. A., 43, 2120e (1949).

A review.

2938. LEYTON, L.

Flame Photometry.

Ann. Repts. Progress Chem. (Chem. Soc., London), 45, 326-30 (1948).

A review of flame photometry with particular emphasis on filter photometers. 21 references.

2939. LOPEZ DE AZCONA, J. M. AND CAMUÑAS PUIG, A.

The Minor Elements of the Ashes of Austurian Coals.

Bol. inst. geol y minero España, 60, 391-400 (1948).

C. A., 45, 7772d (1951).

Qual. spectrographic data are given for Be, Co, Cu, Cr, La, Mn, Ga, Ge, Sr, Ti, V, and Zr in 50 coal samples.

2940. LOPEZ DE AZCONA, J. M. AND CAMUÑAS PUIG, A.

Relation Between the Photographic Density of Spectral Lines and the State of the Alloys of Duralumin Type.

Spectrochim. Acta, 3, 206-13 (1948).

C. A., 42, 7691f (1948).

The d. curves of Al, Cu, Mg, Mn, Fe, and Si in duralumin-type alloys depend on the thermal treatment of the electrodes, in the process of natural aging and artificial aging with temp. increases from room temp. to the m.p. of the alloy. The results agree with prevailing

theories of thermal alterations of mixed crystals in alloys.

2941. LOPEZ DE AZCONA, J. M. AND CAMUÑAS PUIG, A.

Variations in the Intensity of Spectrum Lines Emitted by Alloy Electrodes During Heat Treatment.

Congr. groupe. avance. method. anal. spectrograph. produits mét., 10, 55-64 (1948).

C. A., 43, 5694e (1949).

Electrodes of Duralumin and C steel were placed in an elec. furnace and a high-voltage spark was passed between pairs of electrodes. The intensity ratios of spectrum lines were studied as a function of temp. In the Duralumin samples, lines owing to Cu, Mg, Mn, Fe, and Si were studied relative to Al lines. A max. for all elements was observed at approx. 100°C, corresponding to the temp. at which the alloy had been heat-treated prior to testing. Minima were observed for the various elements at 250 to 350°. These minima were assumed to be caused by the redissolving of the intermetallic compds. (Al_3Cu , Si_3Mg , Al_3Mg_2 , $Al-Mn$, and $FeSi$). Similar curves for the intensity ratio of the 2297 Å. line of C to the 2295 Å line of Fe in steel samples showed a max. at 100° and a min. at approx. 500°.

2942. LUNDEGÅRDH, P. H.

Some Aspects of the Determination and Distribution of Zinc.

Kgl. Lantbruks-Högskol. Ann., 15, 1-36 (1948) (in English).

C. A., 42, 6284g (1948).

The physiol. function of Zn in plants and animals and its distribution as set forth in 80 references are discussed. The paper is a study of the abundance of Zn in the rocks and soils of Sweden. In the spectrographic method L. used, the sensitivity of the plates and the length of the exposure were adjusted to the very short life of Zn in the arc, and the carbon electrodes were protected from rapid burning. The 3345.02 Å line of Zn was measured, and a correction derived from a graph was applied to allow for the variations in this line due to the presence of K, Na, and Ca. Most of the method was as in *C. A.*, 41, 2355c. Data of many determinations of Zn are presented from rocks and soils of Sweden selected to test certain theories about the migration of Zn. It was not found to have been increased in concn. in certain Ordovician sediments, but in these it is shown there was pptn. of $CaCO_3$ (and thus diln.) not as a part of organisms. But in certain other sediments made up of clay minerals or their alteration products into which Zn was evidently drawn by the action of the roots of plants there was found the expected increase in concn. Low concns. of Zn were <100 ppm.

A greenish gray Cambrian sandy slate contained 1000 ppm., and enrichment of a sediment was implied at concns. >100 ppm. and indicated at >200 ppm. Among the crust. rocks the Zn content was parallel to that of biotite; it was generally highest in the more recent acidic rocks and tended to be less in the older than younger rocks of similar compn. The abundance of Zn as found in these analyses is used as a basis of discussion of the mode of formation of various crust. rocks.

2943. MARKS, G. W. AND JONES, B. M.

Method for the Spectrochemical Determination of Beryllium, Cadmium, Zinc, and Indium in Ore Samples.

U. S. Bur. Mines, Repts. Invest. No. 4363, 27 pp. (1948).

C. A., 43, 1281i (1949).

The total-energy method was found to be suitable. It is unnecessary to make corrections for the negligible effects of extraneous elements upon line intensities.

2944. MARKS, G. W. AND POTTER, E. V.

Spectrochemical Determination of Silver in Ores.

U. S. Bur. Mines, Rept. Invest. No. 4377, 14 pp. (1948).

C. A., 43, 2118i (1949).

By using the total energy method, investigations were made of the effects of various elements on the intensities of the lines Ag 3280.68 and 3382.89 Å. The alk. earth metals showed no differences in their effects within the limits of exptl. error. Na, K, S, and Se reduced line intensities, but when S was in chem. combination no marked differences were observed. Fe, Co, and Ni yielded low results which may have been due partly to improper burning in the arc, but the addn. of 60% or more of CaO counteracted the reduction in line intensity. Spectrographic analyses of ore samples and concentrates for Ag, by employing a standard curve based on the line Ag 3280.68 Å, checked the results obtained by fire-assaying methods closely enough to be satisfactory for preliminary or exploratory investigations.

2945. MARLING, J. B.

Spectrographic Determination of Sodium in a Silica-alumina Catalyst.

Anal. Chem., 20, 299-300 (1948).

C. A., 42, 4867g (1948).

An easy and rapid method for the spectrographic detn. of Na involves the use of Cu counterelectrodes as a standard to furnish reference lines. The material to be analyzed is placed in the crater of a graphite electrode and volatilized in an a.-c. arc. This procedure is repeated 3 or 4 times, and the results obtained from the process plate are averaged. The accuracy is adequate for

industrial control and superior to av. chem. methods in the low-percentage range. Analyses are obtained in about 30-50 min.

2946. MARSHALL, S. P. AND DAVIS, G. K.

Composition of Shark Meal.

Jour. Agric. Res., 76, 213-18 (1948).

B. A., 22, 2072, abstract no. 20503 (1948).

Analyses are reported from studies of 19 samples of commercial shark meal processed from sharks caught off the Florida coast. Spectrographic analyses showed Ca, P, Na, Mg, Si, Fe, Sr, Mn, Zn, Pb, Cu, B, and Ba present in 12 samples, Sn in 8, Ni in 3, and Cr in 2 samples.

2947. MASON, R. C.

Some Properties of Gas Discharges Used as Spectral Sources.

Am. Soc. Testing Materials, Symposium on Spectroscopic Light Sources, Spec. Tech. Pub. No. 76, 25-36 (1948).

C. A., 43, 6083e (1949).

The properties are discussed of the pos. column of d.-c. arcs and low- and high-frequency a.-c. arcs. Methods are summarized for external measurements of current, voltage, and length and section of the arc, and for detg. the gas temp. from the velocity of sound in the arc, the absorption of fast particles, and the intensities of band spectra. Special emphasis is placed on the question of thermal equil. in the high-pressure pos. column. Some of the conditions under which equil. exists are given.

2948. MATHER, K. B.

Spectroscopic Characteristics of Ordinary Acheson Graphite.

J. Proc. Roy. Soc. New South Wales, 81 (III), 175-9 (1948).

Spectrochim. Acta, 4, 259 (1950).

The purity and homogeneity of Acheson graphite rods were compared with those of Hilger H.S. brand graphite. The purity was tested by arcing broken $\frac{1}{8}$ in. lengths of $\frac{1}{4}$ in. and $\frac{1}{8}$ in. diameter rods with 10 amp. direct current. Ca, Cu, Ti, V, Al, Si, Mg, Fe, and B were detected in both the Acheson and the Hilger rods, the Acheson however showing the more intense lines. The inhomogeneity of the Acheson rods was found to be very much worse, and made them unreliable for spectrographic analysis. By extracting the cut or broken electrodes in a Pyrex Soxhlet with HCl or HNO₃ for three to four days, an average impurity similar to that of the Hilger rods was obtained although the rods were still too inhomogeneous for use in analysis. Uniformly reliable rods superior in purity to Hilger graphite are obtained by either HCl or HNO₃ extraction for 12 to 15 days.

2949. MESORANA, F. P. AND BRETÓN, A. S.

The Possibility of Using the Electrode

Support as a Reference Element in Spectral Analysis of Solutions.

Anales real soc. españ. fis. y quim., 44A, 641-55 (1948).

C. A., 43, 6537e (1949).

The use of electrode supports was studied as a reference point in spectral analysis, small Zeiss C bars being selected. The reference C line employed had a wave length of 2478 Å. Mg, Mn, and Pb were selected, as their lines do not interfere with the C line. Solns. of MgSO₄, MnSO₄, and Pb(NO₃)₂ in varying strengths were studied, and spectral photographs were taken, by using the 2795 and 2802 Å lines for Mg, the 2576 and 2593 Å lines for Mn, and the 2614 Å line for Pb. A linear relationship was deduced for the relation between the concn. and the log of the blackening. Although variations in the excitation of the spark were rather marked, the error caused by them on the log of the blackening relationship did not exceed 3%.

2950. MILBOURN, M.

Factors Affecting Accuracy in Spectrographic Analysis.

Spectrochim. Acta, 3, 267-77 (1948).

C. A., 43, 2539f (1949).

After a discussion of methods of calcg. and expressing accuracy, factors which are known to influence accuracy in spectrographic analysis are reviewed.

2951. MILBOURN, M. AND HARTLEY, H. E.

Quantitative Spectrographic Analysis by Spark Excitation of Metallic Oxides.

Spectrochim. Acta, 3, 320-6 (1948).

C. A., 43, 2540e (1949).

A new spectrographic technique is described for analyzing a finely ground powder, such as a mixt. of metallic oxides, which is placed in a crater in the lower electrode of a spark discharge. This technique has been used successfully for many metallurgical analyses, more especially those which are not of a routine nature. It appears that ejection is brought about by electrostatic repulsion rather than by thermal or convective effects, and that the large amt. of material passing into the discharge makes it arc-like in character. Sensitivity has been studied by testing synthetic mixts. of Cu and traces of elements. The limits of detection in 10⁻⁴% were 2 Sn, 3 Pb, 1 Fe, 2 Ni, 3 Ag, 1 Sb, 0.5 Bi, and 3 As.

2952. MINCUZZI, C.

Spectrography of Some Products of Vesuvius Fumaroles.

Rend. soc. mineral. ital., 5, 60 (1948) (a preliminary note).

C. A., 46, 3910c (1952).

In Vesuvius ores the chief constituents were alk. and earth alk. sulfates, chlorides, fluorides, and fluoborates; Cu, Mn, P, Pb, and Ti, and, in some cases, Cr, Ba, Sr, Ti, Sn, and Ag were found as minor elements.

2953. MINGUZZI, C. AND VERGNANO, O.

Nickel Content of the Ash of Alyssum Bertolonii.

Atti soc. toscana sci. nat., Mem. 55, Ser. A, 49-74 (1948).

C. A., 44, 9003h (1950).

The particularly high Ni content of the ash is discussed from the geochem. and botanical standpoint. The Ni was detd. separately in different parts of the plant: the leaves contain 10 NiO in the ash, the seeds 9.24%, the roots 5.76%, while the soil on which the plants grew is an ophiolite of Impruneta, Toscana, which contained only 0.42% NiO.

2954. MINTS, I. M.

Spectral Analysis of Iron-nickel-aluminum Alloys.

Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., 12, 457-8 (1948).

C. A., 44, 3405d (1950).

From 10 to 20% Ni in an alloy can be detd. spectrographically by the line pair Ni 4714.4 and Fe 4736.8 Å with an a.-c. arc; 12-16% Co in an a.-c. arc can be detd. by the lines Co 4840.3, Fe 4859.8 Å; Al, in a condensed spark, by the lines Al 5696.5, Ni 5666.6 Å; Cu, 2-6%, also in a condensed spark, by Cu 5153.2, Fe 5133.7 Å. Mean relative errors are, Al $\pm$ 5.0, Ni $\pm$ 3.6, Co $\pm$ 3.8, and Cu $\pm$ 8.0%.

2955. MITCHELL, R. L.

Spectrographic Analysis of Soils, Plants, and Related Materials.

Harpندن, Engl.: Commonwealth Bureau of Soil Sci. (1948), 183 pp. 12s. 6d.

Reviewed in *Anal. Chem.*, 20, 987 (1948) and *Spectrochim. Acta*, 3, 621-2 (1949).

This book reviews the field of spectrographic analysis of soils, plants, and related materials with particular emphasis on methods developed in the Spectrographic Department of the Macaulay Institute for Soil Research. A chapter is included on the preparation of the materials for analysis, and an extensive 27-page bibliography rounds out the book.

2956. MITCHELL, R. L.

Trace Constituents in Soils and Plants. Their Significance and Spectrographic Determination.

Research (London), 1, 159-65 (1948).

C. A., 42, 2043e (1948).

A review with 16 references.

2957. MITCHELL, R. L., AND SCOTT, R. O.

Applications of Chemical Concentration by

Organic Reagents to Spectrographic Analysis.

Spectrochim. Acta, 3, 367-78 (1948).

C. A., 43, 2541e (1949).

Org. precipitants, particularly 8-hydroxyquinoline, have proved satisfactory for this purpose. Results are quoted which show, with a mixt. of 8-hydroxyquinoline, tannic acid, and thionalide, complete recovery of Co, Ni, Mo, Sn, Pb, Zn, Cr, V, Ti, Be, and Ge in a matrix of Al₂O₃, with combined spectrographic and chem. errors seldom exceeding $\pm 10\%$ for 2-100 γ of constituent.

2958. MLADENTSEVA, O. I.

Determination of Zirconium in Magnesium Alloys by Spectral Analysis.

Zavodskaya Lab., 14, 369 (1948).

C. A., 43, 1285c (1949).

Samples were pre-sparked 30 sec. and exposed 20 sec. with a conventional Feussner spark. With Mg lines as internal standards, an av. accuracy of $\pm 5-8\%$ was obtained for Zr contents of 0.3-1%.

2959. MOMIN, A. U.

A Cathode-ray Spectrograph for Studying Emission and Absorption Spectra.

Proc. Indian Acad. Sci., 27A, 391-408 (1948); cf. *Natl. Inst. Sci.*, Aug., 1946;

Proc. Indian Sci. Congr., 1946, 1947, 1948; *Nature*, 160, 130-31 (1947).

C. A., 43, 7810e (1949).

An instrument is described which presents instantaneously on a cathode-ray tube screen a graph of energy distribution against wave length corresponding to any spectral region which is focused on the instrument.

2960. MONNOT, G.

Éléments de spectrographie.

Paris: H. Dunod., 1948. 133 pp.

A general account of spectrochemical analysis covering the physical basis, excitation sources, apparatus, qualitative and quantitative methods. French and other European equipment are featured. Reviewed in *Spectrochim. Acta*, 4, 307 (1951).

2961. MOORE, C. E.

Atomic Energy Levels as Derived from the Analyses of Optical Spectra. I. Sect. 1.

The Spectra of Hydrogen, Deuterium, Helium, Lithium, Beryllium, Boron, Carbon, Nitrogen, Oxygen, and Fluorine.

U. S. Natl. Bur. Standards, Circ. No. 467, 75 pp. (1948).

C. A., 42, 6654e (1948).

All the known energy levels derived from analyses of optical spectra are presented for neutral and ionized atoms of H, D, He, Li, Be, B, C, N, O, and F. For each species of ion is also given the electron configuration,

the term symbol, and energy value of its ground state, the ionization potential or energy required to detach an electron from the ion, and the isoelectronic sequence to which it belongs. For each sequence are tabulated the electron configurations of the various excited states, the terms to be expected theoretically, and those actually found for each state. For each energy level are given its distance in cm^{-1} above the ground state, its designation, and inner quantum no. The literature references are not complete bibliographies for each spectrum but give the authentic sources from which the tabulated data are drawn.

2962. MORITZ, H.

Application of Control-Free Evaluation Methods to Quantitative Spectrochemical Analysis.

Metall., 2, 150-3 (1948).

C. A., 46, 2439h (1952).

After a discussion of the 2-line method of spectral analysis, it is shown that the method can be applied to the detn. of Mg and Si in various Al alloys and pure Al, by using only 1 standard curve per element analyzed.

2963. MORITZ, H.

Spectrochemical Analysis of Impurities in Metals and Solutions Under Special Consideration of Investigations Necessary in Plating Establishments.

Metall., 2, 237-45, 262-8 (1948).

C. A., 43, 8901g (1949).

A review of the application of flame, arc, and spark excitation in the spectral analyses of plating materials.

2964. MUKHERJEE, B.

Spectrographic Determination of Gallium in Indian Bauxite by the Carbon Arc Cathode Layer Method.

Proc. Natl. Inst. Sci. India, 14, 169-75 (1948).

C. A., 43, 3743i (1949).

The C arc layer method applied to the detn. of Ga in 9 different samples of Indian bauxite showed the presence of 0.002 to 0.008% Ga. The arc stand used is described; it is an improvement on that of Quill and Selwood (*C. A.*, 23, 4138). The optical arrangement and the handling of samples are described in detail.

2965. MUKHERJEE, B. AND DUTTA, R.
(Univ. Coll. Sci. Technol., Calcutta).

Spectrographic Analysis of Indian Coal-ash. *Science and Culture*, 14, 213-14 (1948).

C. A., 44, 2202g (1950).

Spectrographic analysis of coal ash from various parts of India was carried out with a quartz spectrograph with purified C rods. A table of results is given. Ge and Ga were present to a considerable extent in some coals.

2966. NACHTRIEB, N. H., CONWAY, J. G.,
WILSON, E. D., AND WEXLER, S.

Simultaneous Photography of Two Wavelength Ranges in Spectrochemical Analysis.

Anal. Chem., 20, 282 (1948).

C. A., 42, 3692e (1948).

By means of a mirror and a second slit, light from the arc is made to strike the grating at a different lateral, and slightly different vertical, angle from that of the light from the first slit. Light from both beams can be received in the same camera, or if emulsions of different sensitivities are desired for the different wavelength ranges, another spectrograph can be used, facing the first and in line with it.

2967. NEUHAUS, C. J.

Spectrographic Analysis of Nickel Alloys.

Iron Age, 161, No. 4, 62-5 (1948).

C. A., 42, 2206a (1948).

In addn. to routine analysis on metal heats, raw materials are analyzed for certain impurities. As an example, the analysis of tar coke for Pb is as follows: To make the sample electrode, a 10-g. sample is ground to 80 mesh, and 0.2 g. of this, 0.2 g. of NH_4Cl , and 0.075 g. of Fe powder are thoroughly mixed and the mixt. is placed in graphite cups, $\frac{1}{4} \times \frac{1}{8}$ in. The auxiliary electrode is graphite. With an excitation of 220 v. d.c., 5 amp., gap 0.16 in., and exposure 90 secs., the time requirement per element per sample is 3 to 4 min. If thin strip, i.e., 0.005 in. or wire 0.020 in. thick, is to be analyzed for Pb, the usual arc methods are not practicable. The interrupted arc, with the duration of the arc current pulses controlled by a high-frequency igniter current, is recommended. Duration of discharges as well as intervals between them can be controlled by a Neotrol timer. With short discharges of about 6 half cycles and intervals of 30 half cycles and a current of 1 amp., Pb can be detd. in Ni wire 0.024 in. thick, with solid electrodes. The high-frequency ignited arc method also is very useful in detg. low concns. of Pb on the surface of thin sheet or tubes. The high-frequency igniter current can also be used in starting semimicro arcs, confined to an area of less than 1 mm. diam. and useful for the analysis of inclusions such as foreign particles inadvertently rolled into the surface of sheet or strip. App. and manipulation are described in detail.

2968. NIEUWENBURG, C. J. VAN

Analytical Chemistry and Chemical Analysis, Now and in the Near Future.

Anal. Chim. Acta, 2, 419-24 (1948) (in English).

C. A., 43, 5691h (1949).

An address in which the important role of spectrographic analysis is noted.

2969. NORMAN, D. P., JOHNSON, W. W. A., AND JOHNSON, N. S.

Spectrographic Study of Treated Textiles. *Am. Dyestuff Rept.*, 37, No. 25, *Proc. Am. Assoc. Textile Chem. Colorists*, P838-48 (1948).

C. A., 43, 3292i (1949).

Spectrographic study of textiles is carried out in quartz or Vycor tubes with a 10-cm. gap between electrodes at 2200 v. with c.d. of 5 amp./sq./cm. and at a pressure of 0.1 mm. Hg. Identification of fibers and of resin treatments upon textiles is made by comparison of band emission spectra with known data. Detn. of resins is also possible, as is the gathering of evidence concerning resin-fiber interaction. Degradation studies may be carried out and changes in bond structure noted. The method also gives data for optimum cure conditions of thermoreactive resins, effect of various catalysts, and other reaction variables. Diagrams of the app. are given plus a table of intensities of band emission spectra for various fibers, and for various resin treatments on textiles.

2970. NOWAK, K.

Carbon and Graphite Electrodes. *Przemysl Chem.*, 4, 300-4 (1948).

C. A., 42, 8673i (1948).

A review. The methods of producing C and graphite electrodes are reviewed and their chem. and phys. properties and operating characteristics are compared.

2971. O'CONNOR, R. T., HEINZELMAN, D. C., AND JEFFERSON, M. E.

Application of the Line-width Method to the Spectrochemical Analysis of the Oils, Fats, and Related Substances.

J. Am. Oil Chemists' Soc., 25, 408-14 (1948).

C. A., 43, 879g (1949).

An ashing procedure for spectrochem. analysis is as follows: Weigh 16.67 g. of fat into a 100-ml. Vycor dish and add 2 ml. of a soln. of 250 g. Mg (NO₃)₂ per l. of 95% alc. The dish is covered with an inverted funnel and heated until the hot plate attains a temp. of 300°; the heating is continued overnight and the charred sample then ashed at 450°. For the detn. 5 mg. of ash is weighed into the electrode crater and the sample consumed by arcing in a direct current arc at 235 v., 20 amp. for 90 sec. The sample is photographed on Eastman spectrum analysis no. 1 plates by using a large Littrow spectrograph set to photograph the ultraviolet region from 2500 to 3500 Å. The plates are then read

with a recording micro-densitometer through the selected Mg lines and all the selected lines of the elements to be detd. From measurements of the width of these Mg lines at the max. densities of each of the lines of the elements being detd. by use of previously prepd. working curves the concns. of the elements in ppm. are obtained. Quantities as low as 1 part in 10 million of Cu, Fe, Mn, Ni, and Sn can be detd. The procedure has been examd. by other precision tests and found to be accurate.

2972. OLDFIELD, J. H.

Spectrographic Examination of Localized Heterogeneity in Metals.

Spectrochim. Acta, 3, 354-66 (1948).

C. A., 43, 2540i (1949).

The area affected by the spark discharge in spectrochem. analysis is usually very small. Consequently errors may arise as a result of local variation in sample compn. To minimize these errors, methods have to be devised to increase the amt. of sample affected by the spark discharge. Examples are given of some of the methods adopted for this purpose. Conversely, a reduction of the area affected by the spark discharge allows a more detailed study to be made of localized variation of sample. A micro-spark technique developed by O. gave a quant. analysis of steel segregates. Examples are described of its subsequent application to a much wider variety of problems. These problems include the identification of inclusions and the study of the degree of diffusion of metals. A simple form of electrode holder which has considerably increased the accuracy of the setting of the micro-spark gap is described.

2973. ORGAN, T. J. AND PARSONS, S. L.

A Method of Spectrographic Analysis of Impurities in Materials for Oxide Coating of Thermionic Cathodes.

J. Optical Soc. Am., 38, 191-5 (1948).

C. A., 42, 2890i (1948).

A method for the quant. spectrographic analysis of the materials used in oxide-coated thermionic cathodes for Fe, Cu, Pb, Mg, Mn, and Al is described. The materials consist of Ba Sr carbonate or Ba Sr Ca carbonate. The basic raw materials consist of Ba(NO₃)₂, Sr(NO₃)₂, and Ca(NO₃)₂. The method employs briquetted samples of approx. 200 mg. placed in graphite-supporting electrodes and burned in a 2200-v. a.-c. arc for 30 sec. to photograph the spectral region 2650-3750 Å. An Fe spectrum is photographed on each plate to provide an emulsion calibration curve and a sample of known concn. is also recorded on each plate to correct for any lateral shifts in the analytical curves. Fifteen samples can each be analyzed for 6 elements in 2 hours with an elapsed time of 80 sec. per detn.

2974. ORSAG, J.

A New Direct-reading Spectrograph.

Congr. groupe. avance. method. anal. spectrograph. produits mét., 10, 99-101 (1948).

C. A., 43, 5666h (1949).

A spectrograph with interchangeable photographic and photoelec. attachment is used. The output of each of two electron multiplier phototubes is recorded on a microammeter, and the instantaneous ratio of the two output currents can be measured by a potentiometer method (cf. Lallemand, *C. A.*, 43, 5693g). The intensity of the reference line is maintained const. by changing the source-slit distance, varying an intermediate diaphragm or varying the slit opening.

2975. ORSAG, J.

A Method of Spectral Analysis Applicable to Traces of Impurities in Metals.

Spectrochim. Acta, 3, 341-5 (1948).

C. A., 43, 2540g (1949).

For estg. volatile impurities in a metal, such that prepn. of alloys by dilns. is inaccurate, it has been found practicable to make use of 3 alloys near the lower limit of chem. analysis for a complete calibration line. Samples contg. 0.01 to 0.06% of sodium in Al were sparked, and with a counterelectrode of pure Al to give a spectrum corresponding to half the Na concn. (The pure Al was freed from sodium by prolonged heating at 900°.) The relative line intensities plotted against the Na percentage on a linear scale gave a straight line passing through the origin, which was therefore used for estg. Na down to 0.0005%.

2976. ORSAG, J.

Spectrographic Analysis in Metallurgy.

Rev. aluminium, 25, No. 144, 151-9 (1948).

C. A., 42, 6697i.

A review.

2977. PARKS, T. D., JOHNSON, H. O., AND LYKKEN, L.

Errors in the Use of a Model 18 Perkin-Elmer Flame Photometer for the Determination of the Alkali Metals.

Anal. Chem., 20, 822-5 (1948).

C. A., 43, 59li (1949).

The interferences of common metals, acids, and solvents on the detn. of Na and K with a model 18 Perkin-Elmer filter flame photometer were studied. Very large neg. errors are caused by appreciable concns. of phosphate, borate, and oxalate ions and by very high concns. of mineral acids. Large errors (either pos. or neg.) are caused by NH_4^+ , alkali, alk. earth, and other cations, particularly when present in high concns.; the magnitude and direction of the errors are not predictable, being frequently of different signs for Na and K. Both MeOH and AcOH when

present in concns. greater than 1% cause pos. errors in the detn. of Na (cf. *C. A.*, 40, 25^g, 2083^g).

2978. PATTERSON, W. A.

Spectrographic Determination of Lead in Blood.

Can. Chem. Process Inds., 32, No. 3, 239-41, 242 (1948).

C. A., 42, 4222c (1948).

The spectrographic method, developed for the detn. of Pb in blood, has been successfully applied in analysis. Ten ml. of blood is ashed and the residue dissolved in 10% soln. of twice-distd. HCl. To 5 ml. of this soln. is added 5 ml. of a buffer soln. contg. a Bi reference standard; 0.1 ml. of the resulting soln. was dried on pure electrodes and ignited in a high-voltage a.-c. arc.

2979. PÉREZ MATEOS, J. AND GÁRATE COPPA, T.

Geochemical Study of Copper Sulfides.

Inst. invest. geol. "Lucas Mallada" (Barcelona), *Estud. geol.*, No. 9, 159-75 (1948).

C. A., 43, 6543d (1949).

Chem. analyses and qual. spectrographic data are given for 17 chalcocites, 7 covellites, and 3 enargites, some impure. In the 27 samples, Ag was detected in 26, As in 10, Bi in 9, Cd in 3, Ga in 2, Ge in 1, In in 3, Pb in 17, Sb in 4, Sn in 15, Zn in 11, Mo in 2, Ni in 5, Co in 6, V in 2, Ca in 6, Al, Mg, Mn, Si, and Ti in most.

2980. PÉREZ MATEOS, J. AND GÁRATE COPPA, T.

Determination of the Elemental Composition of the Compounds of Antimony by Spectral Methods.

Notas y comun. inst. geol. y minero Español, No. 18, 107-22 (1948).

C. A., 44, 73g (1950).

Spectral examn. of 34 samples of Sb_2S_3 showed the presence of 22 distinct elements as impurities. Mg was present in all samples with 10 other elements of importance.

2981. PETER, H. AND KREISSIG, G.

Use of the Flame Photometer of Schunknecht-Waibel without an Auxiliary Current Source and the Substitution of Other Ammonium Salts for Ammonium Acetate and Ammonium Oxalate in the Schachtschabel Method for Determining Potassium.

Z. Pflanzenernähr, Düngung u. Bodenk., 42, 41-4 (1948).

C. A., 43, 6871e (1949).

Substitution of a Se cell for the alkali cell of the photometer is described. In detg. K in soils a soln. of NH_4Cl , $(\text{NH}_4)_2\text{CO}_3$, and

NH₃ can be substituted for the NH₄OAc and (NH₄)₂C₂O₄ in the soil-extn. step.

2982. PETTERSSON, H.

Three Sediment Cores from the Tyrrhenian Sea. II. Remarks on the Results of Analyses on the Core Samples.

Göteborgs Kgl. Vetenskaps-Vitterhets-Samhäl. Handl., 6, Ser. B, 5, No. 13, 15-20 (1948) (in English).

C. A., 44, 10394d (1950).

Brief remarks are presented on the results of the following detns.: H₂O, CaCO₃, N, P₂O₅, B, Be, and the ferrides, as detd. spectrochemically; mineralogical examn.; pollen analysis; investigation of foraminifera; detn. of diatoms; Ra content.

2983. PHÉLINE, J. M.

The Determination of Silicon in Tungstic Acid by a Spectrographic Method.

Group. Avanc. Mèth. Spectr. VII Congress, 51-6 (1948).

Spectrochim. Acta, 4, 183 (1950).

The conditions are given for spectrographic detn. of Si in tungstic acid with greater sensitivity and precision than by current chemical analysis.

2984. PHÉLINE, J. M. AND CASTRO, R.

Determination of Low Boron Concentrations in Steel with a Spectrograph of Average Dispersion.

Congr. groupe. avance. méthod. anal. spectrograph. produits mét., 9, 35-42 (1948).

C. A., 43, 2546a.

A spectrographic method is described which can det. as little as 0.0005% B.

2985. PHÉLINE, J. M. AND CASTRO, R.

Methods of Plate Calibration for Quantitative Spectrochemical Analysis and Their Application.

Congr. groupe. avance. méthod. anal. spectrograph. produits mét., 10, 109-35 (1948).

C. A., 43, 5695a (1949).

A survey of the subject of photographic plate calibration. Data are given for expts. involving: (1) a 7-step Pt. filter, (2) a 7-step Rh filter, (3) a 7-step logarithmic sector, (4) a 10-step logarithmic sector, (5) a continuous logarithmic sector, and (6) a continuous hyperbolic sector.

2986. PIERUCCINI, R.

Spectrographic Determination of Arsenic.

Rev. soc. mineral. ital., 5, 62-3 (1948).

C. A., 46, 3897h (1952).

The following procedure is suggested: Adsorb As from very dil. soln. (fractions of one ppm.) on Fe(OH)₃ pptd. from FeCl₃ by NH₄OH, allow to stand overnight, heat 2.5 hr. on a water bath, filter, wash the ppt.,

dissolve it in HCl, add some drops Br water, and bring to the electrode for the spark spectrum.

2987. POKORNÝ, A.

Use of Solid Electrodes in Spectral Analysis.

Chem. Obzor., 23, 101-5 (1948).

C. A., 42, 8537i (1948).

The various terminal forms of electrodes and the most suitable form for the semiquant. and the standard type for the quant. analysis of steel and cast iron are discussed.

2988. POUVREAU, J.

Study of the Influence of the Microstructure of Electrodes on the Accuracy of Spectrographic Analysis of Alloys of Al, Cu, Mg, Si (A U 4G).

Group Avanc. Mèth. Spectr. VII Congress, 61-63 (1948).

Spectrochim. Acta, 4, 177 (1950).

A large variation occurs in spectrochemical analysis when the electrodes are grossly crystallized; it is indispensable to cast test samples in molds susceptible of conferring a very fine microstructure on the electrodes.

2989. PREOBRAZHENSKAYA, G. P.

Determination of Silicon in Silicon Spring Steel with the Aid of the Steeloscope.

Zavodskaya Lab., 14, 759 (1948).

C. A., 43, 4974h (1949).

A triggered low-voltage a.-c. arc is struck between the sample and a 7-8 mm. Cu rod; Si concns. from 1.1 to 2.0% can be estd. by comparing the intensities of Si lines 3905.52 and Fe 3902.95, 3903.90, and 3906.48/75 Å.

2990. PRETORIUS, P. J. C.

Spectrochemical Determination of Boron in Steel.

J. S. African Chem. Inst., 1, 81-3 (1948).

C. A., 43, 8302f (1949).

The presence of B in steel in quantities as small as 0.005% can be detd. spectrochemically with d.-c. arc excitation, by the lines B 2496.78 and Fe 2496.53 Å. The current employed is 6 amp., the arc length 3 mm., and the slit width 0.04 mm. A table is included for approx. detn. of B in the region 0.0006-0.005%, based on a comparison of intensity of 2 B lines and 5 Fe lines.

2991. PRITCHARD, L. R.

Application of Flame Photometer to Portland Cement Analyses.

Pit and Quarry, 41, No. 1, 83-5 (1948).

C. A., 43, 373f (1949).

An emission spectrometer and the method for detg. alkalis in portland cement are described. The results show an av. deviation of $\pm 0.04\%$ from ASTM standard method.

2992. PROKOP'EV, V. K., STARTSEV, G. P., AND TAGANOV, K. I.
Some Details of the Structure of the Alternating-Current Arc.
Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., 12, 392-4 (1948).
C. A., 44, 3785e (1950).
- Arcs with different electrodes were filmed at 3000 images/sec. and various stages are shown in photographs. The radiating region of the arc spreads at a speed of 8 m./sec., solid oxide particles fly at 10 m./sec., vapor outbursts attain 15 m./sec. Pauses in the arc constitute about 30% of the total. Transfer of matter between electrodes occurs, mainly during the afterglow period after a flash.
2993. RA'KHBAUM, Y., D., AND DYMSHITS, Y., M.
Spectrographic Determination of Silver in Photographic Emulsions.
Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., 12, 477-80 (1948).
C. A., 44, 3821c (1950).
- Samples of the order of 0.04-0.1 sq. cm. of the emulsion are calcined and thoroughly mixed with a known amt. (100-200 mg.) of a mixt. of Na_2SO_4 25, K_2SO_4 25, graphite 50, and Sn 0.05% as standard. The detn. is done in an a.-c. arc under 10 amp., by the line pair Ag 3280.68-Sn 3262.33 Å. The log-log calibration curve is rectilinear between 0.0002 and 0.02% Ag. The probable error of a single detn. is 8.4%. The method was used to det., for various types of emulsions, the photometric consts. and the mean mass of the developed grains.
2994. RANKAMA, K.
On the Geochemistry of Niobium.
Ann. Acad. Sci. Fennicae, Ser. A, III, No. 13, 57 pp. (1948).
Spectrochim. Acta, 3, 658 (1949) (an abstract).
- The spectrographic method used in the investigation is outlined on pages 9 to 11. The niobium in the rock or mineral is in general first concentrated from a solution of the sample, obtained by $\text{HF-H}_2\text{SO}_4$ digestion, by precipitation with phenylarsonic acid. The niobium is then determined in the concentrate by the carbon arc cathode layer technique, the concentrate being diluted with TiO_2 , carbon powder, and NaCl . If the 4058.94 Nb I line used is masked by Fe or Zr lines, the sample is further diluted with TiO_2 . Interference from CaSO_4 in the concentrate was negligible at normal amounts, but 8% CaSO_4 gave apparent niobium contents which were 20% high.
2995. REDMOND, J. C.
Rapid Spectrographic Analysis of Cemented Carbide Compositions.
Steel, 122, No. 26, 86-8 (1948).
C. A., 42, 5798c (1948).
- Material contg. mainly W, Co, C with varying amts. of Ti, Cb, Ta, Fe, Ni, and Mo is ground to a fine powder, in a carbide mortar and photographic plates are made with a stable sparklike discharge. Equipment, technique, and standards are described. Results are within 3 to 10% of those obtained by chem. methods.
2996. RENOARD, P.
The Application of Spectrographic Analysis to Analytical Control in the Light-alloys Industry.
Congr. groupe. avance. method. anal. spectrograph. produits mét., 10, 65-9 (1948).
C. A., 43, 5694b (1949).
- A brief outline of results obtained by a new spectrochem. lab. is given.
2997. REYNOLDS, F. M.
Occurrence of Vanadium, Chromium, and Other Unusual Elements in Certain Coals.
J. Soc. Chem. Ind., 67, 341-5 (1948).
C. A., 43, 1941c (1949).
- Small amts. of rare elements are widely found in coal (cf. Gibson and Selvig *C. A.*, 39, 1272*). Certain vitrainlike coal deposits, found in the roof and floor of coal seams in North Staffordshire and North Wales, are rich in V, Cr, Ti, and Ni. Spectrographic analysis of the ashes of two of the North Wales vitrains also showed the presence of B, 0.01-0.1% of Sb, Ba, Cs, Cu, Ge, Pb, Mo, P, Ru, Sr, Zn and traces of As, Be, Co (In), La, Mn, Ag, and Sn. Cauldron vitrains from Northumberland and Durham contained much less ash (0.12%) but the ash was rich in V and Cr. V-bearing vitrains were also found outside the Coal Measure strata. Theories on the origin of these deposits (cf. Goldschmidt, *C. A.*, 29, 7045*) are discussed.
2998. RIBEIRO FRANCO, R.
Albite from Conselheiro Pena, Minas Gerais.
Mineracao e met. (Rio de Janeiro), 13, No. 73, 47-8 (1948).
C. A., 43, 2549c (1949).
- Results are given of a microscope examn. and spectral analysis. These albite crystals are found assoc. with amethyst, muscovite, bluish green beryl, and dark-green tourmaline, and had d. 2.61 to 2.64.

2999. RIBEIRO FRANCO, R. AND LOEWENSTEIN, W.

Zirconium from the Region of Pocos de Caldas (Brazil).

Am. Mineral., **33**, 142-51 (1948).

C. A., **42**, 3289g (1948).

Zircon, in crystals, occurs with radiating fibrous Zr oxide. The oxide is isotopic and amorphous to X-rays. Spectrographic analysis shows Hf but no Cb, Ta, or Th. Both zircon and the oxide appear to have been formed by the hydrothermal alteration of nepheline syenite contg. Zr minerals such as eudialyte and rosenbuschite.

3000. RIEHM, H.

Determination of Sodium, Potassium, and Calcium in the Flame Photometer by the Method of Riehm-Lange.

Z. anal. Chem., **128**, 249-64 (1948).

C. A., **42**, 5795h (1948).

Cf. C. A., **41**, 4600a.

The app. of Riehm-Lange, which can be purchased, is described and pictured. It can be used advantageously for detg. small quantities of Na, K, and Ca. For Na and Ca, an interference filter of Schott & Gen. is recommended and for K the filter RG8 of the same firm. The measurements can be made in an acetylene-air flame or in a flame of illuminating gas and air. The latter is preferable. Full details are given for making the analyses.

3001. RIVKINA, M. A. AND RUSANOV, A. K. Spectroanalytical Determination of Rare Alkali Metals in Minerals with the Aid of a Flame.

Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., **12**, 467-70 (1948).

C. A., **44**, 3836h (1950).

In a C_2H_2 -air flame, lines of the alkali metals in pollucite (Cs, Rb, Na, Li, K)₂($Si_4Al_3O_{12}$)· H_2O appear only if the sample is fused with $Na_2CO_3 + 20\% Na_2B_4O_7$. Rb is conveniently detd. against In as standard by the line pairs Rb 4201.8-In 4101.0, for Rb 0.07-2.0% mean probable error 4.1%. For Cs 0.06-5.0%, by Cs 4555.3-In 4511.5 Å, error 4.0%; and for Cs 0.18-5.0%, by Cs 4593.2-In 4511.5, error 3.7%.

3002. ROST, F.

Application of the Alternating-current Arc Between Carbon Electrodes to Quantitative Spectrographic Analysis.

Z. angew. Physik, **1**, 136-9 (1948).

C. A., **43**, 4971h (1949).

A 220 v., 6 amp., 50 cycle a.-c. arc is utilized. The sample to be analyzed is introduced into a 1.3 mm. cavity 2 mm. deep in a 5 mm. lower electrode. An arc gap of 2.5 mm. is used. Samples of quartz sand are analyzed for the following elements (listed with range of analysis and probable

error): 0.02-3.0% Al $\pm$ 11%; 0.01-0.1% Ca; 0.005-0.6% Fe $\pm$ 12.5%; 0.003-1.0% Mg $\pm$ 15%; 0.001-0.1% Ti $\pm$ 12%. For the analysis of coke samples, V_2O_5 is added as an internal standard. Samples are analyzed for: 0.05-0.64% Al $\pm$ 20%; 0.02-1.0% Ca $\pm$ 20% 0.05-2.0% Fe $\pm$ 25%; 0.005-0.15% Mg $\pm$ 40%; 0.1-4.8% Si $\pm$ 20%; 0.005-0.05% Ti $\pm$ 25%. Samples of B were analyzed for 0.003-0.1% Mo $\pm$ 35%.

3003. ROST, F. Z.

Progress in the Application of Spectral Analysis in Mineralogy and Geochemistry.

Z. angew. Physik, **1**, 189-95 (1948).

C. A., **43**, 5345g (1949).

A review with 51 references.

3004. ROZSA, J. T.

Improvement of Analytical Control for Silica Brick.

J. Am. Ceram. Soc., **31**, 280-3 (1948).

C. A., **43**, 829d (1949).

A total-energy spectrographic method was developed to det. Al_2O_3 , MgO, Fe_2O_3 , CaO, Na_2O , TiO_2 , K_2O , ZrO_2 , MnO_2 , and Li_2O . Prepn. of the sample requires 30 min., and the spectrographic process 25 min. The total-energy method of Slavin (*C. A.*, **32**, 7367*) was found to be most applicable. Complete consuming of the sample is fundamental. A high-energy intensity arc was used with a simple modification of electrode shape to give thermal equil. While the d.-c. arc method is in disrepute for high concn. work, it is useful in this application because of (1) accurate knowledge of the firing characteristics of the material in the arc, (2) a minimizing of wandering by the use of a long optical path (the stand is placed approx. 110 cm. from the slit), (3) reducing or eliminating partial distn. by complete consumption of the sample and selection of proper size, and (4) the selection of standards similar in compn. to the sample. A spectral range of 2500-4200 Å must be covered. A second-order exposure with a dispersion of 2.5 Å. per mm. included all elements required, except low K_2O . Details of the technique are given. Accuracy in routine detns. is about 5% which is well within production control limits. The method is suitable also for glass sand.

3005. RUDNEVSKIĬ, N. K. AND ZUEVA, K. A. Change of the Temperature of the Arc Through Change of the Thermal Treatment of the Electrodes.

Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., **12**, 416-21 (1948).

C. A., **44**, 3785f (1950).

In an a.-c. arc the abs. intensities of the lines Al 2652, Al 2660, and Si 2516 Å, emitted by Al-Si alloys of 1.44-10.24% Si, were found to be regularly higher for the quenched than

for the annealed alloys. Conversely, the intensity of Al 2816 was mostly lower in the quenched alloys. The intensity differences Al 2652-Al 2816 are consistently higher for the quenched alloys, but the difference Al 2660-Al 2652 is the same for quenched and for annealed samples. The intensity difference Si 2516-Al 2652 A is very slightly greater for the annealed alloys; the difference Si 2516-Cu 2824 is somewhat greater for the quenched specimens. These differences of intensities are greatest in the neighborhood of the electrode, smaller in the middle of the gap. They are evidently due to a change of the temp., depending on the thermal treatment of the alloy electrode. By Mandel'shtam's relation, the variation of the relative intensity I of lines with the temp. T is $\Delta I/I = \Delta T(E_1 - E_2)/kT^2$, where $E =$ the excitation energies of the upper levels of the 2 lines, consequently, for a given ΔT the variation ΔI is the smaller the higher T . In agreement with this prediction, the effect of the thermal treatment on the relative intensities of 2 stated lines was found to decrease with increasing current intensity in the arc, i. e., with increasing temp. In a spark, thermal treatment of the electrode alloy has no effect on the line intensities.

3006. RUSANOV, A. K.

Spektral'nyi analiz rud i mineralov (Spectral Analysis of Ores and Minerals).

Moscow: Gosgeolizdat. 1948. 258 pp.

C. A., 45, 7472c (1951).

Reviewed in *Zavodskaya Lab.*, 16, 128 (1950).

3007. RUSSELL, R. G.

Emission Spectroscopy in an Oil Laboratory.

Anal. Chem., 20, 296-8 (1948).

C. A., 42, 5213g (1948).

The applicability of spectrographic analysis to problems encountered in an oil lab. are discussed. R. describes the qual. analysis of small quantities of oils, sludges, and surface films and also the quant. analysis of alkalis, brines, oil additives, and small quantities of solns.

3008. SABURŌ, Y.

Local Spectral Analysis of a Segregation in Steel.

Proc. Faculty Eng., Keiogijuku Univ., 1, No. 2, 25-8 (1948).

C. A., 44, 1849i (1950).

In the manuf. of a C-steel contg. Si, Mn, Cr, and Mo silver white streaks sometimes appear in the fractured surfaces after the tensile strength test. This causes rejection of the steel although no segregation is apparent metallographically, after etching a polished specimen. S., however, has been able to

detect segregation with the spectrograph. He explains in detail how the spectrograph was used and accounts for the segregation of Mo, Si, and Cr by describing what happens throughout the entire treatment of the steel.

3009. SAKHARNIKOV, P. A.

Spectral Analysis of Alloys for Iron, Titanium, Molybdenum, and Aluminum, with the Aid of an Alternating-current Arc.

Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., 12, 432-5 (1948).

C. A., 44, 3837b (1950).

The following are the spectral line pairs used for the detn. of the element named first, the concn. range, and the mean error in percentage. With a current intensity in the arc of 4 amp., the length of exposure for Fe, Ti, Mo, and Al is 10 sec. Fe 2813.288-Ni 2805.083 Å, 1.5-6.0%, + 1.5%; Fe 2462.644-Ni 2466.958, 0.4-2.0, + 3.5; Fe 2404.882-Ni 2401.841, 0.9-4.0, + 3.5; Fe 2457.60-Ni 2466.958, 2.5-6.0, + 4.5; Ti 2531.251-Ni 2540.02, 1.0-4.5, + 4.5; Al 3082.155-Ni 3099.115, 0.05-0.9, + 5.0; Ti 3241.99-Fe 3259.994, 0.2-0.7, + 3.3; Ti 2646.637-Fe 2635.808, 1.5-4.0, + 3.5; Mo 2775.4-Fe 2772.109, 1.0-4.0, + 2.0; Mo 2930.064-Fe 2929.01, 4.0-7.0, + 2.5.

3010. SANDERS, C.

Corrections for Gamma Changes Due to Variations in Exposure and Development with Reference to Spectrographic Analysis (Two Line-pair Method).

J. Soc. Chem. Ind., 67, 185-7 (1948).

Spectrochim. Acta, 4, 177 (1950).

An analytical procedure is described based on the correlation of density differences (log ratios of galvanometer deflections) with percentage content or log percentage content using two line pairs, one on the positive side and the other on the negative side of zero density difference. By joining the log ratio points on the corresponding concentration-calibration curves, the percentage composition is detd. from the point of intersection of this line with the log ratio line. A weighted average is obtained which corrects for plate response.

3011. SAUTER, E.

Spectroscopic Method for the Detection of Small Quantities of Water.

Z. Naturforsch., 3a, 392-5 (1948).

C. A., 43, 3316a (1949).

The observation of the 3064 Å line of the OH radical can be used to detect water in org. substances at a concn. as low as 1:180,000. The org. vapor is passed through a glow discharge in a specially designed quartz tube. The spectra of secondary reactions vanish at low c.ds. Alcs. do not interfere.

3012. SCHIBLING, G.

A New Method of Precise Spectral Analysis.

Bull. de la soc. franc. de mineral., **71**, 259-305 (1948).

C. A., **43**, 2887g (1949).

The double ray method using an arc rather than a spark seems more advantageous than other procedures (which are reviewed) since it does not require special app. and can be used on conductive or nonconductive bodies without previous manipulations. To det. B in A, obtain a spectrum with uniform light, then translate it horizontally a few tenths of a mm. and take another exposure after adding $n\%$ of B to A.

3013. SCHMIDT, R.

A Useful Variant of the Two-line Method for Calibration of Photographic Emulsions.

Rec. Trav. Chim., Pays-Bas, **67**, 737-44 (1948).

Spectrochim. Acta, **4**, 177 (1950).

A short description is given of J. R. Churchill's [*Indust. Eng. Chem. (Anal. Ed.)*, **16**, 653 (1944)] two-line method of plate calibration, in which the plate calibration curve is derived from a "preliminary curve" of the density of a weak line vs. the density of a strong one, when the two lines are photographed at different density levels. Schmidt shows that the preliminary curve is a straight line with a slope of unity at densities for which the characteristic curve is linear and that this provides a sensitive check on the straight-line portion of the latter. When the preliminary curve is drawn using transformed densities [$\log \{(\dot{i}_0/\dot{i}) - 1\}$] in place of densities [$\log (\dot{i}_0/\dot{i})$], the curve then becomes a straight line for densities between 0.1 and 2.0. The preliminary curve can also be used in conjunction with a step sector, stepped slit, etc., to obtain a more precise plate calibration curve.

3014. SCHMIDT, R.

The Accuracy of Plate Calibration in Spectrographic Analysis. I. A Comparison of the Specific Precision of Different Methods of Calibration.

Congr. groupe. avance. method. anal. spectrograph. produits met., **10**, 137-44 (1948).

C. A., **43**, 5693i (1949).

Integral calibration methods are compared with partial calibration methods and found to be slightly more precise and generally more applicable than shorter methods which rely on the linearity of the H and D curves.

3015. SCHMIDT, R., MANDERS, H., AND WIJK, G. J. VAN.

The Use of the Rotating-step Sector in Combination with Intermittent Light

Sources in Spectrochemical Analysis. III.

Rec. trav. chim. Pays-Bas, **67**, 745-52 (1948) (in English).

C. A., **43**, 2887h (1949).

It has been shown (cf. *C. A.*, **41**, 2654i) that a step sector gives the same calibration curve for a photographic emulsion whether an intermittent or continuous light source is used. This is true if the intermittency effect in the emulsion is negligible. The data previously given are now re-evaluated in a different manner which is based on the two-line method and uses densities according to Seidel's procedure (cf. *C. A.*, **36**, 5705'). It is found that under the above conditions the step sector and two-line method of analysis give identical results but the latter is more precise.

3016. SCHMIDT, R., MANDERS, H., WIJK, G. J. VAN, AND VERKERK, B.

The Accuracy of Plate Calibration in Spectrographic Analysis. II. An Experimental Comparison of Several Methods of Integral Calibration.

Congr. groupe. avance. method. anal. spectrograph. produits met., **10**, 145-58 (1948).

C. A., **43**, 5694a (1949).

A two-line calibration method is shown to be more precise than methods utilizing a step sector or the inverse square law. The step sector and the two-line method yield equiv. results when the reciprocity law failure is negligible. For routine analyses, Fe (or Cu) line calibrations are recommended (cf. Dieke, *C. A.*, **37**, 6547^a).

3017. SCHUHNNECHT, W.

Spectrographic Analysis in Chemical Industry.

Congr. groupe. avance. method. anal. spectrograph. produits met., **10**, 71-5 (1948).

C. A., **43**, 5693e (1949).

For the analysis of nonmetallic samples, an 8000-v., 2-amp. a.-c. arc or an air-acetylene flame is employed. The sample is first dissolved and for arc examn., 0.05 cc. of the soln. is evapd. to dryness on the end of a preheated pure C electrode. Rough quant. analysis is attained by comparison with exposures of C rods contg. known amts. of various elements. Most analyses are performed with the air-acetylene flame. The unknown and several standard samples are run on the same plate. A microphotometer is used in detg. the concn. of impurities.

3018. SCRIBNER, B. F.

Present Status of Excitation in Spectrographic Analysis.

Am. Soc. Testing Materials, Symposium on Spectroscopic Light Sources, Spec. Tech. Pub. No. 76, 2-11 (1948).

C. A., **43**, 5326d (1949).

The two-fold function of excitation sources (1) vaporization and dissoen., and (2) excitation, depends upon the physical state of the sample. Mathematically, it is shown that where excitation is thermal, the intensity of a given spectral line depends upon the concn. of atoms, their ionization potential, and, esp., the effective temp. All of these factors affect the utility of spectrographic analysis, and their interrelations (internal standards, temp. corrections, mixtures of elements, etc.) are discussed. Comparative advantages of the d.-c. arc, the intermittent d.-c. arc, the a.-c. arc, and the spark discharge are noted. Complications in spectrographic analysis are illustrated with alloys and suggestions for their avoidance are made. 26 references.

3019. SEITH, W.

Spectral Analysis of Recast Aluminum for Traces of Cadmium, Nickel, Lead, and Tin.

Mettl., **2**, 117-18 (1948).

C. A., **43**, 3743e (1949).

A method for enriching the surface with impurities in order to increase the sensitivity of the spectrograph was developed. The method consists in an ion-exchange reaction. The impurities are comparatively noble metals. In a suitable soln. they are discharged on a less noble rod. An arc is drawn between this rod, as it is turned in a screwlike fashion, and a pure metal electrode. Samples of 0.5 g. were dissolved in 35 cc. of soln. By soln. of Pb, Cd, Ni, and Sn salts, compns. corresponding to 4 different alloys were prepd. In addn. the solns. contained 15 cc. of a satd. soln. of NH_4Cl and NaOAc and 2 cc. of concd. HCl . The coating required 3 hr.; the rod was then washed and dried. The rod material was very pure Al or Zn. Evaluation was based on photometric detn. of the lines Cu 2961 compared with Pb 2873, Ni 3050, Sn 3175, and Cd 3403. Cu was chosen as reference element. It was necessary to add Al to the test soln. in amts. corresponding to the alloy; otherwise too low values were found.

3020. SEITH, W.

Spectrum Analysis.

FIAT Rev. German Sci., 1939-46, *Analytical Chemistry of Inorganic Substances*, 1948, 92-123.

C. A., **46**, 4415i (1952).

3021. SEMPELS, G.

Analysis of Traces in Non-ferrous Metals.

Applications of the Spectrographic Method After Chemical Concentration.

Spectrochim. Acta, **3**, 346-53 (1948).

C. A., **43**, 2546e (1949).

Combined chem. and spectrographic assay

methods are outlined for Bi and Tl in Pb or Cd and their ores and for Co and Ni in Zn. To sep. Bi and Tl, a fusion of the ore or metal with PbO and a reducing alk. fusion mixt. gives a Pb button contg. all the Bi and most of the Tl. A second fusion completes the extn. of Tl, and these two elements are then estd. spectrographically in the metallic Pb. For sepg. Ni and Co, diethyldithiocarbamate is added to a soln., and a CHCl_3 extn. is followed by distn. to remove the solvent. The residue is converted to metal oxides with a known amt. of An added as nitrate, and the Ni and Co are estd. spectrographically in the oxide. In this way 0.01 p.p.m. of these metals can be estd. in very pure Zn.

3022. SERPASS, E. J., LEVINE, W. S., AND OLIVER, J. E.

Determination of Impurities in Electroplating Solutions. A.E.S. Research Project No. 2. VIII. Traces of Sodium and Potassium in Nickel-plating Baths.

Plating, **35**, 260-3, 297 (1948).

C. A., **42**, 4088i (1948).

Cf. C. A., **42**, 2184e.

The Perkin-Elmer flame photometer was used to detn. Na and K in Ni-plating baths in concns. of 0-100 ppm. Accuracy of about 5% was obtained, and precision of 0.5 ppm. with 50 ppm solns. Baths were dild. 1:9 to prevent deposition of Ni salts on the atomizer jet. Precautions necessary for accurate results were: (1) a 30 min. instrument warm-up, (2) washing of the atomizer after each run, (3) frequent checking of the range control, (4) extreme care in prepn. and handling of standard solns., (5) use of a const. gas-pressure regulator.

3023. SHAPIRO, S. AND HOAGLAND, H.

Flame-photometer Determinations of Sodium and Potassium in Relation to Possible Interference by Phosphate.

Am. J. Physiol., **153**, 428-31 (1948).

C. A., **43**, 266f (1949).

Removal of phosphates by CaO pptn. does not significantly affect flame-photometer detns. of Na or K in urine, homogenized muscle, or ashed muscle if the detns. are made on sufficiently dil. solns. and compared to dil. standards.

3024. SHENSTONE, A. G.

The First Spectrum of Copper (Cu I).

Trans. Roy. Soc. (London), **A241**, 297-322 (1948).

C. A., **42**, 8082i (1948).

In addn. to wavelengths that are presented for all the known lines of Cu I, between 18,229 Å in the infrared and 1504 Å in the extreme ultraviolet, their estd. intensities and character, their wave nos., and the term combinations that produce them. There is also

a tabulation of all known terms together with the electron configuration of their origin, their Rydberg denominators, and their breadths as induced by auto-ionization. Much of Cu I is a more or less regular doublet spectrum produced by excitation of the s-electron out of the configuration $3d^{10}4s$ to the configurations $3d^{10}ns$, $3d^{10}np$, $3d^{10}nd$, and $3d^{10}nf$; but both quartet and doublet combinations arise on excitation of an s-electron out of $3d^44s^2$ to the configurations $3d^44snp$ and $3d^44snd$. Nearly all the states of these latter configurations are above the ionization level $3d^{10}$ and are, therefore, subject to auto-ionization, which widens the energy levels and imparts to the radiated lines a width that cannot be decreased by decreasing the pressure at which the light-source is operated. The 2S and 2D series are closely represented by Ritz formulas which place the limit, $3d^{10}^1S$, of Cu II at 62317.2 cm^{-1} above the ground state of Cu I. Owing to auto-ionization, however, the levels of the $^2P^o$ series are greatly displaced from their normal positions; and in the $^2F^o$ series another kind of perturbation causes inversion of the levels. The $3d^44sns$ series are unique in being the only known complex series in which individual series can be unambiguously assigned to the components of a limit of greater complexity than a doublet. This spectrum is probably now one of the most completely analyzed and offers possibly the best examples of most of the peculiarities that can be met with in at. spectra.

3025. SHEWELL, C. T. AND SHEWELL, J. R.
Pantograph Arrangement for the Correction of an Analytical Curve Obtained by a Spectrum Analysis.

U. S. 2,442,098, May 25, 1948.
C. A., 42, 4804d (1948).

3026. SHIROKOV, V. I.

Electrode Reactions in the Spectral Analysis of Low-carbon Steels.

Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., 12, 412-15 (1948).

C. A., 44, 3842d (1950).

By micrographic and x-ray studies, electrodes of low-C steel with 0.30% C, enriched or not up to 0.50% C by surface cementation, suffer in an a.-c. elec. arc or in a condensed spark a change from pearlite + ferrite to austenite structure. As a result of interaction with N_2 of the air, lines of Fe_4N appear in the x-ray patterns.

3027. SHISTERMAN, K. A. AND USTALOVA, Z. A.

Determining the Basicity of Martensitic Slags by Spectral Analysis.

Zavodskaya Lab., 14, 500 (1948).

C. A., 43, 2120h (1949).

Triturate 0.4 g. slag and 2 g. powd. graphite and make into a briquet 12 mm. in diam. and 9 mm. high. With a Cu counter-electrode and a 5-mm. gap, pre-spark the briquet for 2 min. Observe Ca 6462.5 and Si 6371.0 with a steeloscope and compare with standards whose basicities range from 0.94 to 3.62. The agreement with chem. analysis is excellent.

3028. SHORT, H. G. AND DUTTON, W. L.

Determination of Rare Earth Elements and Yttrium in Uranium Compounds.

Anal. Chem., 20, 1073-6 (1948).

C. A., 43, 1281a (1949).

Most of the U is removed by extg. $UO_2(NO_3)_2$ with ether. The rare earths are then pptd. as fluorides and purified as hydroxides. The final detn. is then made with the spectrograph. With a 50-g. sample, 0.2 parts of Th can be detd. in the presence of 10^6 parts of Gd. Treat 10 g. of the original material with 50% HNO_3 . If necessary, filter off any residue, fuse it with $K_2S_2O_7$ in a Pt crucible, dissolve the cold melt in HCl, and evap. the excess acid on the steam bath. Ppt. the rare earths in this soln. as described below. Evap. the main soln. until crystn. of $UO_2(NO_3)_2$ begins, then cool and break up lumps with a glass rod. Dissolve as much as possible with 70 ml. of Et_2O . Transfer to a sepg. funnel, leaving as much as possible of the residue in the beaker. Wash this with 10 ml. more of Et_2O . Add sufficient water to give 1 ml. of aq. layer, shake, allow the layers to form, and drain off the aq. soln. into the original beaker. Repeat the extn. after adding 1 ml. more of water. Reject the Et_2O soln. contg. the U. Evap. off the ether carefully from the aq. fraction, add a little water and 2 drops of HNO_3 . Evap. nearly to dryness, transfer to a Pt dish and dil. to 50 ml. with water, add 15 ml. of 40% HF and allow to stand overnight. Filter through paper on a waxed funnel and into a waxed beaker. Wash once with water and ignite in a Pt crucible. Wash out the Pt dish with 1-2 ml. of hot concd. H_2SO_4 and add the soln. to the Pt crucible. Evap. to fumes of H_2SO_4 to remove F. Dissolve the residue in 10% HCl and transfer the 5-10 ml. of soln. to a beaker. Add 0.1 g. of salicylic acid and a slight excess of NH_4OH . After 30 min., filter off the insol. hydroxides and wash with 4% NH_3 soln. Ignite, dissolve in a little concd. HCl, and evap. in a depression of a 5-mm. Cu rod. Exam. in a larger Hilger automatic Littrow spectrograph and est. the quantities of the rare earth elements.

3029. SHTUTMAN, M. N.

Use of Spectral Analysis at the Magnitogorsk Metallurgical Combine.

Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., 12, 444-52 (1948).

C. A., 44, 3833e (1950).

Details of procedure for the analysis of basic open-hearth slags, and for detg. Mn, Cr, and Mo at various stages of the production of steel.

3030. SIMEK, B. G., COUFALIK, F., AND STADLER, A.

Germanium Content of Coals of the Ostrava-Karvina Basin.

Zprávy Ústavu Vědecký Výzkum Uhlí, 1948, 167-74 (in English, 174-5).

C. A., 43, 2138h (1949).

Coal ash from various seams was fused with Na_2CO_3 , the melt dissolved in concd. HCl, and GeCl_4 distd. off in a stream of Cl gas. GeCl_4 was pptd. from aq. distillate with H_2S , as GeS_2 and centrifuged. GeS_2 was dissolved in KOH. This liquid was used to impregnate a pure graphite electrode of the Zeiss spectrocope having 2 quartz prisms. The ash of certain high-volatile coals contains Ge in approx. 10^{-4} concn.; ash of most of the coals contains 10^{-6} Ge. There is no connection between Ge concn. and the location of the seams. Ge apparently has no effect in the utilization of coal, e.g. a catalytic effect in hydrogenation of the coal.

3031. SINCLAIR, D. A.

A Condensed Arc Source Unit for Spectrochemical Analysis.

J. Optical Soc. Am., 38, 547-53 (1948).

C. A., 42, 5280a (1948).

In this paper is described a unit of the spark-ignited arc type that has been developed to bridge the gap between the sensitive but erratic d.-c. arc and the more reproducible but less sensitive spark sources previously available. The unit may be simply and inexpensively constructed from standard equipment and provides d.-c. and a.-c. arcs either condensed or uncondensed. Some critical requirements for the successful operation of this type of source unit are discussed, illustrations of various cycles are given, and a comparison is made between the different types of arc-current pulses.

3032. SMITH, A. L. AND FASSEL, V. A.

Combined Shutter and Projection Device for Alignment of Electrodes in Spectrographic Analysis.

Anal. Chem., 20, 782 (1948).

C. A., 42, 8537h (1948).

A solenoid-operated mirror-shutter for projection alignment of spectrographic electrodes is described.

3033. SMITH, D. M.

Spectrographic Analysis of Tin and Tin-lead Solders.

Tin Research Inst., Greenford, England (1948). 31 pp.

C. A., 42, 6268a (1948).

A summary is given of present knowledge, in part unpublished, concerning equipment and technique suitable for the analysis of com. Sn and its alloys. Standard alloys were prepd. of (a) alloys with Al, (b) alloys with Ag, Cd, and Sb, (c) alloys with Zn, (d) alloys with Al, Dc, and Zn, (e) alloys with Pb and Bi, and (f) alloys with Cu. Plates show several of the spectra with Sn lines at 2706.5, 2913.5, 2761.6, 3141.8, 3218.7, 3233.6, Pb lines at 2802.0 and 2833.1, and the Bi line at 3067.7 Å. The positions of Fe, Mg, and Cu lines are also shown. The estd. limits of spectrographic detection is stated for Al, Sb, As, Bi, Cd, Cu, In, Fe, Pb, Ni, Ag, and Zn. The least sensitive test is for As which requires 0.01%.

3034. SMITH, D. M. AND WIGGINS, G. M.

Some Improvements in the Technique of Spectrographic Analysis of High-purity Materials.

Spectrochim. Acta, 3, 327-40 (1948).

C. A., 43, 2539d (1949).

A review of work with the intermittent a.-c. arc and the const. current d.-c. arc. The C arc in steam is used for the analysis of rare earth oxides. Sometimes the concave mirror has advantages as a mode of spectrographic slit irradiation and line-intensity variations across the arc gap and variations with time of running the arc have been studied. A method for the complete qual. analysis of volatile elements and compds., by using certain exposure periods during the continuous running of the arc, is suggested.

3035. SMITH, F. M., SCHRENK, W. G., AND KING, H. H.

Spectrographic Determination of Boron in Plant Tissue.

Anal. Chem., 20, 941-3 (1948).

C. A., 43, 1682c (1949).

A spectrographic procedure or good precision for the detn. of B in plant ash employs the d.-c. arc for excitation. Sn is used as an internal standard and LiCl as a buffer. The plant material is ashed at 600°. A weighed portion of ash is treated with HCl, evapd. to dryness, and taken up in a soln. of internal standard and buffer. A 0.1-ml. aliquot is evapd. to dryness on the electrode. The sample is burned in a d.-c. arc with a blunt-nosed cathode. Line densities are detd. with a densitometer and compared with those produced by standards of known concn. Blunt-nosed cathodes are preferred for increased precision. A probable error of 1.43% was obtained with alfalfa samples contg. 36.6 ppm. of B. With pointed electrodes a probable error of 2.70% was obtained with samples contg. 28.4 ppm. The results agree well with data obtained colorimetrically with quinalizarin reagent. In 9 alfalfa samples of varying B content, spectrographic analyses averaged 6.3% lower

than the colorimetric procedure. The method has also been used successfully on wheat grain. The simultaneous est. of P, Mn, and Mg by this procedure is possible.

3036. SMITH, G. S.

Progress of Spectrochemical Analysis in Emission Spectroscopy up to 1943 in the U.S.S.R.

Spectrochim. Acta, 3, 235-46 (1948).

C. A., 42, 7649i (1948).

An interesting report, with bibliography of 28 papers (mostly Russian).

3036a. SOMIYA, T., AND MIZUIKE, A.

Quantitative Spectrochemical Analysis of the Mixture of Hydrogen and Nitrogen by Means of an Optical Wedge.

J. Chem. Soc. Japan, Ind. Chem. Sect., 51, 55-6 (1948).

C.A., 47, 9857a (1953).

The possibility is shown for the analysis of a mixt. of H and N within 10% by measuring the brightness of spark spectra with an optical wedge.

3037. SPICER, W. M.

Spectrochemical Determination of Copper in Copper-zinc and in Copper-nickel Alloys.

Anal. Chem., 20, 557-8 (1948).

C. A., 42, 6266a (1948).

A study of Cu-Zn and Cu-Ni alloys was undertaken in order to det. whether the method of Hasler and Kemp (cf. *C. A.*, 38, 1181²) could be applied to the analysis of these alloys. Only solid solns. are involved in these alloys and hence difficulties due to segregation are avoided. The samples of Cu-Zn alloy were strips, 3" × 1" × 0.06". These were made upper electrodes with lower electrodes of purified graphite. With a critically damped discharge using a Multisource unit supplied by the Applied Research Labs., it was found that the spark line 2884.383 Å of Cu varies in intensity relative to the arc line 2882.934 Å as the percentage of Cu varied from 70 to 97%. A curve is given for the variation of this intensity ratio with the Cu content of brass. The same method was applied to Cu-Ni alloys and a curve is given showing the variation of the intensity of the Cu line ratio with Cu content of Cu-Ni alloys. In this case, the intensity ratio was const. below a Cu content of 85%. It was found that the shape of the electrodes influenced the results. This is explained by the variation of thermal cond. of these alloys with Cu content.

3038. STACE, H. C. T.

The Spectrochemical Determination of Magnesium in Soil Extracts by the

Lundegardh Air-acetylene Flame Technique.

J. Council Sci. Ind. Research, Australia, 21, 305-7 (1948).

C. A., 43, 8590i (1949).

For accurate detns. of Mg, the standard solns. used must have approx. the same Ca contents as the sample extracts.

3039. STREADMAN, L. T.

A Spectrochemical Method for the Determination of Uranium.

J. Opt. Soc. Am., 38, 1100 (1948) (an abstract).

Microgram amounts of U are analytically determined by means of the d.-c. carbon arc and a B. & L. medium quartz spectrograph. If necessary, the U is separated from extraneous materials by a modification of the ether extraction method of Furman and co-workers. The sample is placed in the negative electrode, the light from which is focused on the prism. The sample is burned in the crater of a purified graphite rod or, for higher sensitivity, is arced on the flat end of a carbon electrode. Relative intensities are determined by a sector method employing a rotating half-cylinder in front of the slit, with a slit width of 10 microns. A 50-fold increase in sensitivity is obtained by adding about 10 mg. RbCl as an enhancing agent to the electrode along with the sample. Lines measured are the unresolved U lines 2882.6, 2882.7, and 2882.9 Å, and the line 2650.8 Å of the internal standard Pt. The calibration curves extend from 0.02 to 20 micrograms of U in the arc. The standard error of a single determination is about ±15 per cent.

3040. STEELE, S. D.

Summarized Proceedings of Conference on Industrial Spectroscopy—Glasgow 1947.

J. Sci. Instr., 25, 95-102 (1948).

This covers the following papers: Mitchell, R. L., and Scott, R. O.: The spectrographic analysis of non-conducting powders in the carbon arc; Selwyn, E. W. H.: The photographic aspect of spectroscopy; Mitchell, G. P. and Popper, P.: The use of the electron multiplier in emission spectroscopy.

3041. STEINBERG, R. H. AND BELIC, H. J.

Spark Technique in the Spectrographic Analysis of Slags.

Anal. Chem., 20, 72-3 (1948).

C. A., 42, 2206f (1948).

A method is described for the quant. spectrographic analysis of open-hearth slag samples for lime-silica ratio with a reproducibility within 10% of the truth. A high-voltage, low-inductance, condensed spark was used for the excitation. The lower electrode was cupped and filled with powd. slag cemented with Ethocel in BuOAc. Calibra-

tion curves were prep'd. for 3900 to 4300 Å and analytical curves by plotting the log relative intensities against the log ratios of % CaO to % SiO₂. The ratio was read from this curve. Free CaO caused the results to run high.

3042. SUKHENKO, K. A., MLADENTSEVA, O. I., AND YAKOVLEVA, N. P.
Spectral Analysis of Complex Alloys of Nickel, Cobalt, and Aluminum.
Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., 12, 436-8 (1948).
C. A., 44, 3838d (1950).

The following are the line pairs used, the mean error (and the corresponding concn. of the unknown element), in analyses for the element named first. In Ni alloys: Cr 2861-Ni 2863 Å, 4.2% (20.4%); Cr 2862-Ni 2863, 7.0 (20.4); Cr 147-Ni 3012, 3.5 (20.4); Cr 2851-Ni 2863, 4.7 (20.4); Cr 2853-Ni 2863, 6.0 (20.4); Al 3961-Ni 3783, 15.3 (0.77); Si 2528-Ni 2546, 10.4 (1.00); Mn 2593-Ni 2546, 10.0 (0.55); Mn 2593-Ni 2584, 11.1 (0.55); Ti 3261-Ni 3012, 10.9 (2.30); Ti 3261-Ni 3087, 11.8 (2.30); Fe 2599-Ni 2566, 8.6 (1.30); Fe 2599-Ni 2546, 12.3 (1.30). In Co alloys: Cr 2863-Co 2649; Cr 2861-Co 2649; Cr 2853-Co 2649; Cr 2851-Co 2649; Mn 2594-Co 2649; Si 2516-Co 2649; Fe 2599-Co 2649; Fe 2598-Co 2649; Fe 2399-Co 2467; Ni 2438-Co 2467; Ni 2394-Co 2398; W 2489-Co 2649; W 2683-Co 2649; W 2603-Co 2649; W 2589-Co 2649. In Al alloys: Zn 3302-Al 3050; Zn 3282-Al 3050; Zn 2557-Al 2652; in a condensed spark, also Zn 2502-Al 2652; Mg 2779-Al 2652, for 2-6%, with Fe not over 0.8%; Mg 2915-Al 2652, and Mg 2776-Al 2652, for 9-16% Mg; Mg 2795-Al 2652, and Mg 2802-Al 2652, for Mg of the order of 0.001%.

3043. SUKHENKO, K. A. AND YAKOVLEVA, N. P.
Spectral Determination of Carbon in Steels and Cast Irons.
Zavodskaya Lab., 14, 625-7 (1948).
C. A., 43, 6540c (1949).

The lines for C at 2296.8 and for Fe at 2311.3 were selected. Excitation was both with an a.-c. arc and with a condenser spark with increased capacity (0.08 μF). The arc was satisfactory as far as intensity of C line was concerned but it was somewhat unstable and Fe oxides formed on the electrodes. These defects were eliminated with a high voltage spark and in addn. the abs. intensity of the C line and sensitivity to variations in concn. were improved. Conditions were: tension 15,000 v., capacity 0.03 μF, self induction 0, spark gap 1.5 mm., sparking time 20 sec., current in primary circuit 5-6 amp.,

exposure 1 min., developing 50 sec., supporting electrode of Armco Fe. The concn. was det'd. from empirical curves of unalloyed steels and cast irons. Mean arithmetical error was ±11.5%.

- 3043a. SVENTITSKII, N. S.
The Steelscope and its Application.
Gostekhizdat, Moscow-Leningrad (1948)
240 pp.

The first Soviet spectroscopic for sorting steel—the steelscope—was designed in 1933. It is stated with conviction that the Soviet Union stands in first place in both the development of steelscopic methods and in their introduction into industry. This book was written for engineers and laboratory steelscopists. A detailed description and discussion is given of the SL-3 steelscope, the instrument most widely used in the Soviet Union. The steelscopes made by the Zeiss and Hilger firms are regarded as inconvenient and less successful in design. A discussion of light sources is confined to direct-current arcs and alternating-current arcs with spark ignition. Specific methods of analysis with the aid of the steelscope are given. The analysis of steels is conducted either with a standard iron electrode, or with a copper one, and quantitative results are obtained from homologous pairs of spectral lines. Attempts to apply the steelscope to the analysis of copper-base or aluminum alloys have been less successful, partly because the method of homologous pairs encounters difficulties due to the comparative poverty of these spectra.

3044. SVENTITSKII, N. S. AND TAGANOV, K. I.
Spectral Analysis by Transference in the Electric Spark.
Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., 12, 396-401 (1948).
C. A., 44, 3833f (1950).

The method consists in first allowing material from the alloy electrode to be transferred, through an elec. spark, to an auxiliary electrode, and then using the latter as the sample electrode in an elec. arc. The final detn. is made either by photometry of a line pair, as Cr 4254.3-Fe 3271.71 Å for Cr in steel, or by visual observation of the length of persistence of a line of the element. By the spark-transference method, the slopes of the calibration curves, log of the ratio of intensities against log concn., or time of persistence against concn., are steeper than by the direct method, i.e., the spark transference method, in both its variants, is more sensitive. The amt. of material transferred by the spark is a function of the spark gap, passing through a max. at about 0.5 mm. It increases with the length of sparking only up to a point.

3045. SWETT, H.

The Spectrograph as an Aid to Quality Control.

Western Metals, 6, No. 5, 40-2 (1948).

C. A., 42, 5792f (1948).

3046. TAWDE, N. R. AND UNVALA, H. A.

Direct Method of Measuring Relative Spectral Intensities: Its Technique and Use in Line and Band Spectra.

J. Univ. Bombay, 16, No. 23, 79-98 (1948).

C. A., 43, 1652f (1949).

The exptl. arrangement consists of a const. deviation glass monochromator with an extension tube contg. a focusing lens mounted on the exit-slit. A Weston photonic cell was mounted on this tube and the image of the exit-slit focused on its light-sensitive surface. This primary photocell was connected to a primary galvanometer the small deflections of which were amplified by a photoelec. relay causing a large deflection of a secondary galvanometer. This arrangement is calibrated by means of a tungsten-band lamp operated at a temp. of 2420°K. Observations were limited to the spectral range 5000 to 7000 Å because the radiant flux of the incandescent lamps and the sensitivity of the photocell are both too small at shorter wave lengths and some stray radiation was found at longer wave lengths. The distribution of flux in the spectra of 5 incandescent lamps, a 4-amp. copper arc, and a quartz mercury arc is shown. The relative intensities of Cu lines 5782, 5700, 5219, 5153, 5106 Å are reported proportional to 134, 136, 550, 363, 900, resp. In a 4.5-amp. mercury arc the relative intensities of 5791, 5770, 5461 Å are found proportional to 45, 71, 460, resp. These values are probably in doubt by $\pm 10\%$ because of the unsteadiness of the arcs emitting the line spectra.

3047. ТИХОМИРОВА, N. K.

Semiquantitative Analysis of Light Alloys with the Steelscope.

Zavodskaya Lab., 14, 245-7 (1948).

C. A., 43, 970e (1949).

Comparison line pairs are indicated for detg. Mg, Cu, Mn, and Si in Al alloys, and Zn and Al in Mg alloys, with an Fe counter-electrode.

3048. TOMSON, N. M.

Content of Metals in Atmospheric Dust and Its Effect on Living Organisms.

Gigiena i Sanit., 13, No. 10, 11-13 (1948).

C. A., 43, 4988b (1949).

Analysis of ash of animal bodies can serve as an index of atm. contamination by heavy metals. White rats exposed to the atm. of a plant working with nonferrous metals over 5 months (dust level 0.02-0.05% mg./cu. m.) showed: 95 mg./kg. Pb in the bones, 23 in liver, and 6-13 in other organs (controls 12.1,

3.7, 0.6, resp.). The expelled dust after settling on surrounding soil is absorbed by plants, and analysis of leaves of the vegetation around the plant showed 6-20 fold increase (over controls) of Pb content, in addn. to which Sn and Ag were also found. The analysis was done spectrographically.

3049. TONGERBEN, W. VAN.

The Dow-Baird Associates Automatic Spectrometer.

Congr. groupe. avance. méthodes anal. spectrograph. produits métal., 10, 87-90 (1948).

C. A., 43, 5235f (1949).

A brief description of the instrument (cf. *C. A.*, 42, 5b).

3050. TOSCANI, A.

Spectrochemical Studies of the Macigno and Pietraforte Near Florence.

Atti soc. nat. e mat. Modena, 79, 85-88 (1948).

C. A., 45, 86c (1951).

Besides the most common elements, chemically detd., the spectrochem. analysis shows Co, Cr, Cu, Ni, Ba, V, and Zr.

3051. TOTH, S. J., PRINCE, A. L., WALLACE, A., AND MIKKELSEN, D. S.

Rapid Determination of Eight Mineral Elements in Plant Tissue by a Systematic Procedure Involving Use of a Flame Photometer.

Soil Sci., 66, 459-66 (1948).

C. A., 43, 3314c (1949).

A procedure is given for the detn. of Ca, Na, K, Mg, Fe, Mn, P, and S. The plant samples are wet ashed, the SiO₂ removed, and Ca, Na, and K detd. in the filtrate with the flame photometer. P is detd. colorimetrically as the reduced phosphomolybdate complex. Mn is detd. colorimetrically as permanganate after oxidation with periodate. Fe is detd. as the ferrous o-phenanthroline complex. S is pptd. and weighed as BaSO₄. Mg is detd. colorimetrically with Thiazol Yellow as a colored Mg lake, after the removal of R₂O₃ and Ca. The results are nearly identical with those obtained by conventional methods.

3052. TRICHÉ, H.

Spectrographic Determination of the Solubility of Cadmium in Solid Tin.

Compt. rend., 227, 52-4 (1948).

C. A., 43, 8949h (1949).

Direct arcing of deeply etched specimens of Cd-Sn alloys, heat-treated below 128° (two-phase region) indicates that the tin-rich phase contains 0.31 wt. % Cd.

3053. TRICHÉ, H.

The Application of Spectrographic Analysis of Surfaces to the Study of Impurities.

Congr. groupe. avance. méthodes anal. spectrograph. produits métal., 10, 77-8 (1948).
C. A., 43, 5694c (1949).

Samples of Zn and Sn-Cd alloy are dipped in acid. The impurities (such as Ag) not attacked by the acid become concd. on the surface. Analysis is then accomplished by passing a Tesla spark between the prepd. surface and a counterelectrode of the pure metal (Zn or Sn-Cd alloy). The surface is moved during exposure so that a considerable area is covered by the spark.

3054. TUTTLE, H. A. AND BRYAN, F. R.
 Molybdenum-mold Samples Increase Accuracy of Spectrographic Analysis.
Iron Age, 162, No. 26, 57-9 (1948).
C. A., 43, 1279i (1949).

By casting samples in a Mo insert mold, spectrographic analytical deviations have been cut to as little as $\frac{1}{4}$ of the variance experienced with samples from Fe molds.

3055. UNSÖLD, A.
 Correction to the Paper "Quantitative Spectrum Analysis of the Sun's Atmosphere."
Z. Astrophys., 25, 352 (1948).
C. A., 44, 930i (1950).

Except for H, the values of log NH for various atoms and ions in the sun's atm., reported previously (*C. A.*, 43, 38i), are to be decreased by 1.03.

3056. VAUCOULBURS, G. DE (Sorbonne, Paris).
 Origin and Correction of Local Errors in Photographic Photometry.
Rev. optique, 27, 541-6 (1948).
C. A., 43, 51c (1949).

Photometric and micrographic measurements of the spots of unequal optical d. on a uniformly exposed photographic plate show that they are not due to inequalities in thickness on the base on which the sensitive emulsion is coated, as hitherto believed, but rather to the nonuniform distribution of the Ag grains in the emulsion between its top and bottom surfaces.

3057. VENCOV, St.
 Purification of Carbon Electrodes Used for Spectrographic Analysis.
Bul. Inst. Natl. Cercetari Tehnol., 3, 471-5 (1948).
C. A., 43, 3732c (1949).

After reviewing methods used for cleaning C electrodes, the following treatment is recommended: The electrodes are boiled and soaked at high temp. in a mixt. of concd. HCl and HNO₃, H₂SO₄, NH₄OH, and glacial AcOH, rinsing them with distd. water before each new cleaning soln. After drying them

in an elec. furnace, the electrodes are subjected to thermal treatment in a N atm. This eliminates most of the impurities, leaving only B, Cu, Si, and Fe. Prolonged treatment eliminates the traces of the last 2 elements.

3058. VINOGRADOV, A. P.
 Distribution of Chemical Elements in Subterranean Waters of Various Origins (Significance of Coefficients of Proportionality).
Trudy Lab. Hidrogeol. Problem, im. F. P. Savarenskogo, 1, 25-35 (1948).
C. A., 46, 3338a (1952).

The ratio between chem. elements or ions of similar physicochem. properties and particularly the ratios between individual chem. elements and their rare or widely-disseminated assoc. elements is used to throw light on the unsolved problem of the genesis of various natural waters (fresh, mineral, and sea). The ratios used are: Ca-Sr, Ba-Sr, Ra-Ba, Na-Li, K-Li, K-Rb, B-Cl, and Cl-Br. Iodine is exceptional so that the ratios Cl-I and Br-I are not of the same significance for this purpose. The 25 waters whose analyses are listed were collected in 1938 from 2 Russian regions especially for the detn. of their content of widely-disseminated chem. elements. Sr and Li were detd. by the T. F. Borovic-Romanova spectrographic method (*C. A.*, 32, 7495; *C. A.*, 37, 310), with an error of 12%; Br and I, by the method of L. S. Selivanov and E. V. Manzhinskii (*C. A.*, 22, 717). Boron was detd. directly by the method of Tseitlin (*C. A.*, 34, 4202^a; 37, 1926^a; and 40, 5332^a) with an error of 10%. In addn. many published water analyses contg. data for detg. these ratios are quoted, including 5 from Clarke (*C. A.*, 19, 1839).

3059. VOLKOV, V. I.
 Use of the Steeloscope in the Analysis of Steam-turbine Components.
Zavodskaya Lab., 14, 627 (1948).
C. A., 43, 6473d (1949).

In analyzing rivets which join the blades and disk in the rotor of a steam turbine, the portable steeloscope and condenser were placed near the rotor, one line was connected to the rotor and the other line to a clamp for supporting the const. electrode. Const electrodes were of low-C steel rods, 10 mm. in diam., 60 mm. long, and beveled at 35°. Both a.-c. and d.-c. arcs were satisfactory. The distance between the source of light and the condenser lens varied from 300 to 600 mm., depending on the size of wheel. The exact position of the steeloscope was detd. with the aid of an arc between the const. electrode and a flat bar of Fe which was suspended from the disk in line with the rivets in order not to subject one of the rivets to unnecessary heating. The analysis of rivets

from 8 disks required 8 hr. In analyzing rivets of a disk ready to be installed, the same arrangement was used but the steelscope was stationary, the const. electrode was of Cu and the distance from the source of light to the lens was 600 mm.

3060. VREELAND, F. K.

A Direct-reading Analytical Spectroscope.
Am. Mineral., **33**, 600-11 (1948).
C. A., **43**, 8746g (1949).

A compact, direct-reading spectroscope is described which is suitable for rapid qual. work.

3061. WAAL, D. M. DE AND NAUDÉ, S. M.

Sample Electrode Vapor Contamination of the Graphite Electrode in the Flat-surface Sparking Technique of Spectrochemical Analysis.

Spectrochim. Acta, **3**, 127-40 (1948).
C. A., **42**, 7652i (1948).

In the flat-surface (point to plane) technique of spectrochem. analysis, some of the vapor released from the sample electrode during sparking is condensed on the graphite counter electrode. The latter then contributes to the radiation of the sample spectrum. The degree of contamination depends on the discharge-type and spark-gap parameters. The appearance of contamination is in itself not objectionable but rather an aid, in that the electrode system then approximates the classical system of self-electrodes.

3062. WAAL, D. M. DE AND STRASHEIM, A.

Investigation of Spectrochemical Sparking-off Effects in the Flat-surface Sparking of Steels.

Spectrochim. Acta, **3**, 141-58 (1948).
C. A., **42**, 7653b (1948).

The differences between the spark types obtained with two electrodes of a sample and with a flat surface opposite a counter electrode of graphite become apparent when their sparking-off curves (line-intensity ratio vs. time of sparking) are compared. Analysis of these curves points to a large effect of oxidation and to the role of water vapor in the spark atm. It is suggested that variable atm. humidity may be a major cause of curve drift. These investigations led to the adoption of a short spark gap (1.5 mm.) and a blunt graphite electrode for the flat-surface sparking of steel samples.

3063. WAGER, L. R. AND MITCHELL, R. L.

The Distribution of Chromium, Vanadium, Nickel, Cobalt, and Copper During the Fractional Crystallization of a Basic Magma.

Intern. Geol. Congr. Rept. of the 18th Session, Gt. Brit., 1948, Pt. II, 140-50 (Pub. 1950).

C. A., **45**, 2831d (1951).

The content of Cr, V, Ni, Co, and Cu, as detd. by spectrochem. analysis, is presented for typical rocks of the Skaergaard intrusion in E. Greenland and in plagioclases, pyroxenes, olivines, ilmenites, and magnetites sepd. from the rocks. The data are discussed from petrological and crystal chem. viewpoints, and the distribution ratios of the 5 metals between liquid and cryst. phases are calcd. 16 references.

3064. WERNER, O.

Electric Equipment for Excitation in Qualitative and Quantitative Spectrographic Analyses.

Metall., **2**, 69-75, 114-17 (1948).
C. A., **43**, 1273a (1949).

For the majority of analyses of Fe, steel, and nonferrous metals either the high-voltage spark or the elec. arc is used. For qual. analyses, greater flexibility is desired to adapt the method to varying requirements. Diagrams of 3 circuits for generation of high-voltage spark are given. The effective secondary voltage is between 10 and 15 kv. The low-voltage arc differs from the above mostly in the current which is 3-10 amp. or $\frac{1}{10}$ of the current involved in the higher-voltage spark. The time of discharge in the arc is much longer and amounts to 10 to 60 sec. Mechanically and electrically excited interrupted arcs are described and their characteristics compared. Other methods described are low-voltage spark, high-voltage arc, and high-frequency spark.

3065. WILLARD, H. H., ET AL.

INSTRUMENTAL METHODS OF ANALYSIS.

New York: D. Van Nostrand Co., 247 pp. (1948).

C. A., **43**, 522h (1949).

This textbook includes treatments of spectrography, flame photometry, spectrophotometry and Raman spectrography. Current developments in equipment are discussed and illustrated. Laboratory directions are provided for the adjustment and use of various instruments including flame photometers and small spectrographs.

3066. WILSON, S. H.

A Comparison of the Sensitivity of Spectrographic and Radiotracer Methods.

J. Phys. & Colloid Chem., **52**, 1260-1 (1948).

C. A., **43**, 2113i (1949).

This is a comment on the paper of Schubert and Richter (*C. A.*, **42**, 5301a) concerning the detn. of dissoen. const. of Sr complexes when the Sr is present in concns. of approx. 10^{-11} mole per l. The purity of the materials was established by spectrographic analysis. W. points out that, because of the universal contamination of all substances by all elements,

the amt. of Sr present as impurity may have exceeded by far the amt. of radiotracer added, without being detected spectrographically. The values of disson. consts. are, however, not affected.

3067. WOLFF, H.

Spectroscopic Studies on the Aluminum Content of the Blood.

Biochem. Z., 319, 1-8 (1948).

C. A., 43, 4322b (1949).

A 20-ml. sample of blood is taken and mixed with 1 ml. 10% Al and Co free Na citrate. To this is added 1 ml. 4.0379% CoCl_2 (= 10 mg. Co), and the blood is dried at 150° for 6-8 hr. The dry material is ground to a fine powder in an agate mortar, transferred to a Pt dish, and ashed at 450°. Residues of C are treated with concd. HNO_3 and removed by repeated ashing. The ash is finally transferred with HCl to the agate mortar, dried and finely powd. This powder is used on the electrodes to obtain the emission spectrum. The blood samples were taken from 24 women and 40 men ranging in ages from 18 to 48 years. The av. Al content was found to be 55% (28-92%) in the women and 53% (21-94%) in the men. For men the highest frequency was 47%.

3068. WOLFF, H.

Quantitative Spectrum Analysis of Trace Elements in Blood and Organs.

Biochem. Z., 318, 430-53 (1948).

Spectrochim. Acta, 3, 471 (1948) (an abstract).

Description of techniques, using the high-voltage a.-c. arc.

3069. WOLFF, H.

Spectrochemical Studies of the Manganese Content of Blood.

Biochem. Z., 318, 521-30 (1948).

Spectrochim. Acta, 3, 472 (1948) (an abstract).

After elaborate preparation the oxidized, dried, and pulverized sample is placed in a carbon electrode to photograph its spectrum when excited by a high-voltage a.-c. arc. The Mn content of blood lies between 0.1

and 0.3 γ in 100 cm^3 , measured in 12 women and 48 men.

3070. WOLFF, H.

The Quantitative Spectral Determination of Trace Elements in Blood and Organs.

Klin. Wochenschrift, 26, 310-311 (1948).

The importance of emission spectrochemical analysis is pointed out and is illustrated by determination of Mn and Al.

3071. ZAK, A. E.

Determination of Tin, Arsenic, Antimony, Zinc, and Nickel in Lead.

Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., 12, 463 (1948).

C. A., 44, 3402g (1950).

Spectral detns. in an a.-c. arc with 3 interruptions per sec gave an accuracy of $\pm 10\%$ for: Sn 0.01-0.0005%, line 3175 Å; As, 0.01-0.001%, 2348.8 Å; Zn 0.1-0.001%; 3345.0 Å, or, in the absence of Na, 3302 Å; Ni, 0.01-0.0002%, 3414.8 Å.

3072. ZHURAVLEV, G. I. AND TERE-SHCHEENKO, P. N.

Spectrographic Analysis of Chromium-Cobalt Base Alloys.

Zavodskaya Lab., 14, 1101-5 (1948).

C. A., 45, 4602a (1951).

Hemispherical tips were ground on sample pins with an alundum wheel. By comparing the intensities of Mo 2644, Fe 2599, Si 2516, and Mn 2049 with Co 2648, and Ni 2394 with Co 2397, Mo, Fe, Si, Mn, and Ni were detd. in steels and similar alloys to within 0.6-5.6%.

3073. ZINOV'EV, V. V.

Possible Use of the Spectral Method for the Identification of Coal Deposits.

Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., 12, 475-6 (1948).

C. A., 44, 3695h (1950).

Preliminary report on geological classification of coal deposits on the basis of spectral analyses for Si, Ti, Al, Ge, V, Cr, Mg, Ni, Ir, Pr, etc.

1949

3074. AGNEW, J. T., FRANKLIN, R. G., BANN, R. E., AND BAZARIAN, A.

Combustion studies with the Orthicon Spectrograph.

J. Optical Soc. Am., 39, 409-10 (1949).

C. A., 43, 5312h (1949).

Application of the image orthicon and electronic instrumentation to spectroscopy has provided increased light sensitivity, greater spectral range of response, and time resolution of a higher order than can be obtained

with a moving film or plate. The instrument consists essentially of a television pick-up tube, the RCA image orthicon, whose photosensitive surface is placed in the focal plane of a large-aperture spectrograph. A curve of intensity vs. wavelength (0.45 to 1.0 μ), at any chosen instant or succession of instants, appears on the screen of an oscilloscope whose scans are synchronized with those of the orthicon, and recurrent traces are photographic with a high-speed drum camera. A recent study has been made of the

explosion in a bomb of a mixture of *n*-heptane 3.5, O 62.8, and N 33.7% by vol. Spectra of the explosion were obtained at the rate of one every millisecond.

3075. ALEKSEVA, A. I.
Spectrum Analysis of Metallic Lead.
Zavodskaya Lab., 15, 700-3 (1949).
C. A., 44, 478g (1950).
Suitable spectral lines are listed.

3076. ALEKSEVA, A. I. AND NAÏMARK, L. E.
Spectrographic Determination of High Concentrations of Antimony in Lead.
Zavodskaya Lab., 15, 1437-9 (1949).
C. A., 46, 853f (1952).

The following line pairs are homologous in a spark discharge and can be used to det. 2-10% Sb in Pb: Sb 3267.5 Å, Pb 3220.5 Å; Sb 3029.8 Å, Pb 3118.6 Å; Sb 3040.6 Å, Pb 3017 Å.

3077. ALPATOV, M. S.
Spectrographic Determination of Phosphorus in Cast Iron.
Zavodskaya Lab., 15, 857-8 (1949).
C. A., 44, 480i (1950).

The detn. is best based on the 2149.8 Å line of P, with the 2151.7 Å line of Fe for reference.

3078. ASMUS, E.
Optical Apparatus for Clinical Industry and Research.
Chem. Ing. Tech., 21, 376-81 (1949).
C. A., 44, 877e (1950).
An extensive treatise with many figures.

3079. AUGHBY, H.
A Rapid Mobile Analyzer for Minute Amounts of Lead in Air.
J. Optical Soc. Am., 39, 292-3 (1949).
C. A., 43, 4523a (1949).

Atm. contamination by Pb presents acute problems in analysis and control to the chem. industry. A mobile instrument of extreme sensitivity has been developed which furnishes a rapid indication and an approx. assay of localized relatively high concns. of Pb, combined or elemental. Samples are drawn through a condensed spark discharge adjusted to minimize air lines and to excite the Pb spectrum 2203.5 Å which is photographed with a small quartz instrument. Visual examn. of a series of exposures provides data on Pb concn. as a function of time and location. A sensitivity of better than 1 part in 20 million can be maintained in routine operation. Instantaneous response has been realized by substitution of the photoelec. Geiger counter for the photographic plate.

3080. AYERBUKH, M. M. AND ERINA, I. I.
Quantitative Analysis of Non-Ferrous Alloys by Using a Steeloscope with a Photometric Ocular.
Zavodskaya Lab., 15, 1431-4 (1949).
C. A., 46, 829a (1952).

A neutral d. wedge is placed over the right half of the ocular field, with the d. gradient vertical. A line of the element being detd. is brought into the clear half of the field, and the d. wedge displaced until the apparent intensity of some base element line in the right half of the field matches that of the unfiltered line. The position of the wedge is recorded for known concns. of the minor element, and a working curve constructed. Precision and accuracy equal those obtained with photographic methods.

3081. BABAEVA, A. V. AND LAPIN, E. S.
Spectral Determination of Small Quantities of Iron in Platinum and Palladium.
Izvest. Sektora Platiny i Drugikh Blagorod. Metal., Inst. Obshchei i Neorg. Khim., Akad. Nauk S.S.S.R., No. 23, 94-6 (1949).
C. A. 45, 1906i (1951).

Fe contents of 0.001-0.05% were detd. spectrographically by means of Pt and Pd lines for comparison. To det. Fe in Pt the lines used were: Fe 3030.640, Pt 3022.847 (arc); Fe 3020.640, Pt 3005.783 (arc); Fe 2599.396, Pt 2625.33 (spark). For Pd the lines were Fe 2994.429, Pd 3021.749 (arc); Fe 2973.23, Pd 3021.749 (arc); Fe 2994.44, Pd 2577.10 Å (arc). For traces of Fe in Pt, the av. error was 9% and for Fe in Pd 8%.

3082. BABAEVA, A. V. AND LAPIN, E. S.
Spectral Determination of Small Quantities of Platinum and Palladium in Refined Silver.
Izvest. Sektora Platiny i Drugikh Blagorod. Metal., Inst. Obshchei i Neorg. Khim., Akad. Nauk S.S.S.R., No. 23, 97-100 (1949).
C. A., 45, 1908d (1951).

For detg. Pt and Pd in Ag the 3-standard method was used. A total of 15 standards was used contg. 0.00005-0.200% Pt and Pd each. The standard alloys were forged and drawn into 3-4 cm. lengths having a square cross section of 2.5 sq. mm. and one end wedge-shaped. The wires were used as electrodes. For detg. concns. of 0.02-0.2% the following lines were used: Pt 2702.40, Ag 2721.77; Pt 2733.96, Ag 2721.77; Pd 3489.77, Ag 3501.94; Pd 3460.77, Ag 3501.94; and for concns. of 0.001-0.02% Pt 2997.97, Ag 3099.12; Pt 2997.97, Ag 2721.77; Pd 3489.77, Ag 3542.61; Pd 3242.70, Ag 3130.01 Å.

3083. BACHELDER, M. C.

Effect of Constituent Materials on Spectrographic Measurement of Seven Impurity Elements.

Anal. Chem., 21, 1366-9 (1949).

C. A., 44, 1846a (1950).

If one burns completely on a matrix of MgO, C, NaCl, PbO, or Fe a 350- γ sample contg. Sn, Cd, Co, V, Be, Sb, and Mn, the following conclusions can be drawn: Under the conditions described in this paper, the spectrographic detn. of an element in any one matrix can be made by comparison with an analytical curve prepd. for the element in another matrix. The error in the measurement of any one of the 7 elements listed by the proper choice of matrix for the standard curve, can be limited to a high factor of 2 and a low factor of 0.5. The presence of many impurities or a large quantity of one element does not affect these limiting factors.

3084. BAILEY, G. L. J.

Report of Discussion on the Application of Electron Multipliers to Spectroscopy, London, May, 1948.

J. Sci. Instrum., 26 [2] 53-6 (1949).

Spectrochim. Acta, 4, 179 (1950).

Opening statements were made by G. L. J. Bailey (application of multiplier photocells in quantitative metallurgical analysis, with reference to published American work) and F. Holmes (outline of desirable requirements). The general properties of photomultipliers and details of particular types were described by S. Rodda and A. Sommer, in the form of a reply to the first two speakers. Some experiences in the application of R.C.A. cells to spectrography were discussed by P. Popper, and the general discussion was opened by Prof. R. Breckpot.

3085. BARNES, E. C., PIROS, W. E., BRYSON, T. C., AND WIENER, G. W.

Spectrochemical Determination of Beryllium in Micro-quantities.

Anal. Chem., 21, 1281-3 (1949).

C. A., 44, 477e (1950).

A spectrochemical procedure with a d.-c. arc for detg. as little as 0.04 γ Be per l. of urine is described. The sample is prepd. by a phosphate pptn. to which Al is added to act as an internal standard. The Be is detd. by comparing the d. of the Be line 2348.6 Å with the Al line 2321.6 Å. The method has also been applied to samples of tissue and air.

3086. BARROW, R. F. AND CALDIN, E. F.

Some Spectroscopic Observations on Pyrotechnic Flames.

Proc. Phys. Soc. (London), 62B, 32-9 (1949).

C. A., 44, 939c (1950).

The results of a spectroscopic study of the white or colored flames from typical pyrotechnic compns. are reported. Most of the visible light from these sources comes from a limited no. of at. or diat. emitters. The effects of secondary emitters on the dominant wavelength, colorimetric purity, and relative intensity are considered in general terms and some suggestions for improving the quality of the flames are put forward. The spectra of the flames were photographed in the first order of a 2.4-m. concave grating in an Eagle mounting, which gives a nearly linear dispersion of about 7.4 Å./mm. Typical compns. studied are blue, potassium chlorate 63%, copper carbonate 15%, HgCl 10%, shellac 12%; yellow, potassium chlorate 55%, sodium oxalate 30%, shellac 15%; white, aluminum 22%, barium nitrate 75%, S 3%; green barium nitrate 50%, barium chlorate 40%, shellac 10%; red, potassium chlorate 15%, strontium nitrate 65%, shellac 20%; white Mg 50%, barium nitrate 45%, paraffin wax 5%. Ideal red, orange, yellow, and green sources have nearly the same relative luminous intensities at const. temp., and the blue sources are roughly 0.01 to 0.0001 as luminous. Any hopes of producing a blue flame depending on thermal excitation comparable in intensity with the other colored flames are illusory. There seem to be no very promising alternatives to BaCl among the diat. mols., although BO might be useful; it is also possible that a suitable means might be found for exciting the green line of Ti (5350 Å).

3087. BATT, G. AND DUYCKAERT, G.

New Analytical Techniques at the University of Liège.

Chim. anal., 31, 52-60 (1949).

C. A., 43, 3741i (1949).

Analytical chemistry has borrowed largely from the field of physics, as this description of modern instruments (including spectroscopic) used at Liège shows.

3088. BEALE, P. T.

Spectrographic Analysis. Use of the General-Purpose Source Unit for Non-ferrous Alloys.

Metal Ind. (London), 75, 43-5, 49 (1949).

C. A., 43, 7857i (1949).

The spectrographic methods in use at the British Non-Ferrous Metals Research Assocn. for analysis of Al, brass, Ni, Zn, Sn, and their alloys are described. A general-purpose source unit was used throughout, and all estns. were made with a microphotometer.

3089. BENN, R. E., FOOTE, W. S., AND CHASE, C. T.

The Image Orthicon in Spectroscopy.

J. Opt. Soc. Am., 39, 529-32 (1949).

Use of the image orthicon tube as a detector in spectroscopy provides rapid response at

controlled instants and, for short exposure times, greater light sensitivity than the photographic plate. The application of the orthicon spectrograph to the study of transient or rapidly varying light sources is discussed.

3090. BERLIN, T. I.

Rapid Determination of Aluminum in OTsS Bronze, LOS Brass, and in Copper-silica and Copper-nickel Alloys with the Steeloscope.

Zavodskaya Lab., 15, 1480 (1949).

C. A., 44, 4366e (1950).

Analysis of 0.12–0.005% Al is satisfactorily done by using the 3944 and 3961.5 Å lines for Al, and comparing with the 3973.5 Å Ni line, with an a.-c. arc.

3091. BERNSTEIN, R. E.

The Estimation of Serum Potassium and Sodium by Means of the Internal Standard Flame Photometer.

S. African J. Med. Sci., 14, 163–70 (1949).

C. A., 44, 5418g (1950).

The principle of internal standard flame photometry, employing a low-temp. flame source and a means of compensation for atomization variables and interference with the light emission by foreign substances is described. The instrument errors are minimized by the compensation of the Li internal standard. The photometer must be calibrated frequently with known ionic concns. covering the range expected in the unknowns. For estg. K, add 1 ml. of serum to 2 ml. of distd. water and 1 ml. of 20% CCl_3COOH . Then add 4 ml. of 20 mg. of Li per 100 ml. (final concn. of Li 10 mg./10 ml., as for calibration solns.), mix well, centrifuge to pack down the ppt. and transfer the supernatant fluid to the atomizer. To eliminate the effect of Na on the results of K estn., a calibration curve was drawn covering a range of 0–4 mg. of K/100 ml. with K solns. to which 40 mg. of Na/100 ml. had been added. This reduced to less than 1% of the effect of variable Na content of pathol. serums. The K concn. in mg./100 ml. of serum is given by the calibration curve reading $\times$ diln. (i. e., 8). For estg. Na, add 0.2 ml. of serum to 4.6 ml. of distd. water, and 0.2 ml. of 20% of CCl_3COOH (or 4.8 ml. of distd. water if protein pptn. is not carried out), add 5 ml. of 20 mg. of Li/100 ml., mix well, centrifuge, and transfer the supernatant to the atomizer. The Na concn. in mg. of Na/100 ml. of serum is given by the calibration curve reading $\times$ diln. (i. e., 50).

3092. BERTA, R. AND PALISCA, A.

A New System of Spectrographic Analysis of Bronzes.

Met. ital., 41, 128–34 (1949).

C. A., 43, 8944f (1949).

By use of a counter-electrode of very pure Bi, the Sn, Zn, Pb, etc., in bronze can be detd. with results as accurate as a good chem. analysis.

3093. BERTOLANI, M.

Boron in Silicates.

Atti soc. toscana sci. nat. Pisa, Mem., Ser. A, 56, 59–82 (1949).

C. A., 45, 2378e (1951).

Spectrochem. analysis of 153 silicate minerals showed less than 0.003% B_2O_3 for most. Higher contents were noted in andradite from Arendal (1.26%), in epidotes (0.017, 0.005, 0.009), prehnites (0.06, 0.017, 0.295, 0.009, 0.018), thorite 0.15, cerite 0.102, gadolinite 0.095, vesuvianites (0.363, 0.113), bustamite 0.019, chamosite 0.039, muscovites (0.024, 0.266,) pinit 0.043, manganophyllite 0.133, lepidolites (0.056, 0.052), albite 0.017, oligoclase 0.005, labradorite 0.063, scapolites (0.069, 0.129), and petalite 0.363%.

3094. BERTON, A.

Spark Spectrography Using, as Support for the Analyzed Material, a Band of Paper Moving at Constant Speed Between the Electrodes.

Bull. soc. chim. France, 1–2, 94–9 (1949).

C. A., 43, 6104h (1949).

A strip of paper 1.5 $\times$ 10 cm. impregnated with the sample is affixed to the periphery of a drum. The drum is rotated by a synchronous motor so that the projecting strip passes between two graphite electrodes at a speed of approx. 10 cm. per sec. A hot, condensed spark is struck through the paper. For sol. samples ashless filter paper is used. The method has been used for the detn. of Al, Ba, Ca, Cu, Fe, Mg, Mn, Ni, P, Pb, Si, and Ti, in biol. materials, and in com. papers (*C. A.*, 42, 5373b).

3095. BERTRAND, D.

Distribution of Lithium in Seeds.

Bull. soc. chim. biol., 31, 5–7 (1949).

C. A., 43, 5828d (1949).

Forty widely diverse species were examd. In general, the seeds contained a lower percentage of Li than the remainder of the plant. Cereal seeds contained 0.01–0.13 mg. Li per kg. dry wt., and other species 0.04–0.56 mg./kg.

3096. BERTRAND, G. AND BERTRAND, D.

The Rubidium Content of Wine.

Ann. agron., 19, 837–42 (1949).

C. A., 44, 3205e (1950).

Samples of 22 French wines were evapd. to dryness, then ignited, and the total dry matter and total ash detd. The ash was then converted to chloride and K, Na, and Rb were detd. spectroscopically with the aid of a recording electrophotometer. White wines

generally contained less than 1 mg. of Rb per l., red wines 2-3 mg., and rose-colored wines, 0.54-1.97 mg. Similar detns. were made on 5 varieties of French grapes and on 2 wines made from one of these varieties; one from the must only and the other fermented in contact with the skins, the stems, and the seeds. Sep. analyses were also made on whole grapes, grapes with the seed removed, on the flesh, the skin, the seed, and the stems of 3 varieties. The skins and the stems were richer in Rb than the flesh; therefore, wine prep'd. from the must only contains less alkali metal than the whole grape or the whole bunch.

3097. BERTRAND, G. AND BERTRAND, D.
Rubidium Content of Wines.
Ann. inst. Pasteur, **77**, 541-3 (1949).
C. A., **45**, 305h (1951).

White wines contain in general less than 1 mg. Rb/l.; red wines and pink wines contain 2 to 3 times more.

Causes of Variation in the Rubidium Content of Wines.

Ibid., 544-9.

Rb content of different varieties of grapes varies from 2 to 9 mg./kg. dry wt. Red grapes have twice the Rb content of white grapes. This is one factor contributing to the Rb content of wines. The other is the wine-making procedure.

3098. BERTRAND, G. AND BERTRAND, D.
Rubidium Content of Wines.
Compt. rend., **228**, 1622-5 (1949).
C. A., **43**, 8091e (1949).

The Rb content of wines may vary widely, for example from 0.22 to 4.16 mg. Rb per l. This is found to be due to variation in Rb content of the grapes and to variation in the method of producing the wine. The skins and stems of the grape are richer in Rb than the flesh, and if the entire cluster is employed in fermentation, the Rb content is higher.

3099. BERTRAND, G. AND BERTRAND, D.
Normal Existence of Cesium in Plants.
Compt. rend., **229**, 453-5 (1949).
C. A., **44**, 709a (1950).

Spectrographic analyses of ashes derived from phanerogamic plants showed the presence of Cs in amts. ranging from 3 to 88.5 mg. per kg. dry wt. with a mean of about 22 mg. In fungi the amt. was 22.8 mg. per kg. The Cs was det'd. from its 4555.5 Å line measured indirectly through the increased intensity of the 4554 Å Ba line.

3100. BERTRAND, G. AND BERTRAND, D.
The Presence of Cesium in Arable Soils.
Compt. rend., **229**, 533-5 (1949).
C. A., **44**, 2155f (1950).

During analysis of samples from flowering plants significant quantities of Cs were noted with 21.9 mg. of Cs and 20.1 mg. of Rb per kg. of dried tissue. Spectrographic analysis of the soils on which these plants were grown indicated presence of Cs with quantities ranging from 0.3 mg. per kg. to 25.7 mg. per kg.

3101. BILLS, C. E., McDONALD, F. G., NIEDERMEIER, W., AND SCHWARTZ, M. C.
Reduction of Error in Flame Photometry.
Anal. Chem., **21**, 1076-80 (1949).
C. A., **43**, 8943f (1949).

Performance of a Model 18 Perkin-Elmer flame photometer in detg. Na or K in the range 0-10 ppm is improved by a newly designed amplification circuit. Prepn. of samples is described, together with methods for correcting errors where the test element is in low ratio to the total ash.

3102. BILLS, C. E., McDONALD, F. G., NIEDERMEIER, W., AND SCHWARTZ, M. C.
Sodium and Potassium in Foods and Water. Determination by the Flame Photometer.
J. Am. Dietetic Assoc., **25**, 304-14 (1949).
C. A., **43**, 4780e (1949).

Na and K detns. on about 500 foods and 150 public water supplies are presented. A discussion of the occurrence of Na in foods and water is given, together with incidental comparisons on analytical methods.

3103. BOLTZ, D. F.
Modern Instrumental Analysis, Vol. I.
Ann Arbor, Mich: Edwards Bros. (1949), 191 pp.

Fundamental principles, construction and operation of typical instruments, and practical applications in chemical analysis and research are presented in six chapters by six specialists. The chapter titles and authors are: (1) Quantitative spectrochemical analysis, J. R. Churchill; (2) Application of spectrochemical analysis, J. R. Churchill; (3) Mass spectrometry, H. F. Wiley and C. E. Berry; (4) Optical instruments, K. J. Heinicke; (5) Electron diffraction, L. O. Brockway; (6) X-ray diffraction, E. J. Bickel. The first two chapters, in 77 pages, constitute a good review of modern practice in spectrochemical analysis.

3104. BOROVIK, S. A.
Determination of Sulfur, Selenium, and Halogens in Ores and Minerals by Spectral Analysis. Method of Spectral Analysis of Solutions.
Doklady Akad. Nauk S.S.S.R., **65**, 315-18 (1949).
C. A., **44**, 10592f (1950).

Powd. sample is deposited on a massive Cu bar moistened with collodion (dild. with AmOAc), dried at 120°, and installed as the lower electrode (circuit diagram is reproduced) with a cone-shaped upper Cu electrode. As the arc proceeds to burn, the lower electrode is automatically moved in a horizontal plane below the upper electrode, exposing fresh sample surfaces for arcing. The most satisfactory lines found were: for S 2863.6 (10), 2855.9 (8), 5453.9 (7), 5032.4 (6); for Se 5176.0 (10), 5227.5 (10), 2630.9 (10); 2778.0 (8); for Cl 4794.5 (10), 4810.0 (8), 5423.2 (7), 3191.4 (6); for I 5161.2 (10), 5405.65 (8), 5464.6 (8), 2872.9 (9); for Br 2926.3 (10), 3562.4 (10), 4704.9 (9), 4678.7 (8); for F 6856.0, 6239.6, and 6348.5 Å. The 6064.4 Å line of CaF₂ may also be utilized; this line is not due to F *per se*; it is best developed in d.-c. arc. The horizontal bar electrode is also suitable for analysis of solns.

3104a. BOROVİK, S. A. AND BOROVİK-ROMANOVA, T. F.

Content of Rare Elements in Insects from Data of Spectrum Analysis.

Trudy Biogeokhim. Lab., Akad. Nauk S.S.S.R., No. 9, 149-54 (1949).

C. A., 47, 7682h (1953).

Numerous analyses of specimens of Coleoptera, Orthoptera, Hymenoptera, and Lepidoptera groups are cited. In all cases small amts. of Pb, Sn, Co, Ni, Cu, Ag, Zn, Zr, Bi, Ga, Be, Cr, V, Sr, Ba, Mo, Ti, and Mn are found. Very great variations among individuals are noted. Pb is found in all cases, the following in fewer instances (in order): Mo, Sr, Ba, Cr, Zr. Almost absent in Orthoptera are Ag and Sn, but these are always present in Coleoptera and Hymenoptera. Ga, Be and Bi are found in occasional specimens.

3104b. BOROVKOV, V. V. AND KORZĖ, P. D.

Sorting Thin Steel Wire on a Steelscope. *Zavodskaya Lab.*, 15, 744-6 (1949).

C. A., 47, 2663f (1953).

The mechanically cleaned wire either in single strands or bundles (if under 1.5 mm.) clamped in a holder can be examd. readily in spark discharge app. For Cr and V detn. the comparison lines are those of Fe. Ni and Mo can be also estd. satisfactorily. Examples of typical examns. of steel specimens made in U.S.S.R. are cited. It is possible to classify the specimens by their compn. even in cases of very thin wires (0.02 mm.) without errors.

3105. BOYLE, A. J., WHITEHEAD, T., BIRD, E. J., BATCHELOR, T. M., ISERI, LLOYD T., JACOBSON, S. D., AND MYERS, GORDON B.

Emission Spectrograph for the Determination of Na, K, Ca, Mg, and Fe in Plasma and Urine.

J. Lab. Clin. Med., 34, 625-30 (1949).

C. A., 43, 7071i (1949).

An emission spectrograph employing a rotating disk electrode is used to det. Na, K, Ca, Mg, and Fe in plasma and urine with an accuracy of $\pm 5-10\%$. Proteins are destroyed by either (Et)₄-NOH or HNO₃-HClO₄ (2:1) before sparking. Li was found to be the most suitable internal standard. Details of the instrument used, prepn. of samples, and working curves are given. 4 cc. heparinized plasma pipetted into a 250-ml. beaker to which are added 15 cc. of 2:1 nitric-perchloric acid mixture and 3 cc. of 0.3 g. per cent lithium chloride soln. Beaker covered with a watch glass and soln. permitted to evaporate to incipient dryness. 5 cc. dist. water are then added to the cooled beaker and contents swirled until soln. is complete.

Urine.—To 10 cc. urine in 250 beaker are added 10 cc. HCl, 15 cc. of 2:1 nitric-perchloric acid and 3 cc. of 0.3 g. per cent LiCl soln. Treated same as plasma except 10 cc. water finally added. Uses rotating pure graphite electrode $\frac{1}{2}$ " in diam., $\frac{1}{4}$ " thick dipping in soln., 2 kva.-full ind., 40 sec. pre-spark, 40 sec. exposure.

3106. BRAUDO, C. J., CRAGGS, J. D., AND WILLIAMS, G. C.

The Excitation Temperature in a Spectroscopic Spark Source.

Spectrochim. Acta, 3, 546-59 (1949).

C. A., 43, 8277b (1949).

The excitation temp. in a gaseous discharge can be detd. if spectral lines of known transition probabilities are excited in a gaseous discharge and their relative intensities measured. This technique is applied in some preliminary expts. on a low-voltage, high-power triggered spark-arc source. Observations on the relative intensities of certain Mg and Ba lines gave excitation temps. ranging from 5000° to 16,000°. By altering the circuit consts. it appears possible to vary the excitation temp. over a range of approx. 2:1.

3107. BRECKPOT, R.

Determination of Phosphorus in Steels. A New Direct Reading Electronic Spectrometer.

Congr. groupement avance. method. anal. spectrograph produits mèl., 12, 99-103 (1949).

C. A., 45, 4173f (1951).

The relative intensities of P₂₁₃₆₋₁₉ and P₂₁₄₉₋₁₁ to an internal standard, Fe₂₁₃₆₋₅₅, were studied both photographically and electronically for the detn. of 0.01 to 0.1% of P. The use of an electron multiplier tube in the electronic equipment described eliminated the need of a sensitizing agent and permitted percentages to be read directly from a microam-

meter. Results reproducible to within $\pm 2\%$ were obtained in 15 sec.

3108. BRECKPOT, R. AND JUCHNIEWICZ, B.
Spectrographic Study of the Flame of a Thomas Converter.

Congr. groupement avance. méthod. anal. spectrograph. produits mét., 12, 137-9 (1949).

C. A., 45, 3779g (1951).

The spectrum of the flame from 2100 to 9000 Å was recorded both photographically and electronically. During the carburization period the lines, some bands, and a background continuum developed to a max. emission. At the transition point the bands and nearly all the lines disappeared. During the dephosphorization period the rays were either absent or extremely weak and the spectrum was essentially a continuous radiation which increased progressively in intensity towards the ultraviolet. The lines of Li, Na, K, Rb, Cs, Ca, Ga, Cu, Ag, Fe, Mn, Pb, and Cr, and the bands of MnO, FeO, CaO, and OH were identified.

3109. BRECKPOT, R. AND MARZEC, K.
Instantaneous Spectrophotometric Determination of Phosphorus in Steel.

Bull. soc. chim. Belges, 58, 280-1 (1949).

C. A., 44, 6765c (1950).

The intensity of the 2136.19-Å line is detd. with photomultiplier tubes.

3110. BŘESKÝ, L.
Spectroanalysis of Aluminum, Zinc, and Their Alloys.

Hutník, 16, 128-30 (1949).

C. A., 44, 1358i (1950).

A detailed description is given of the procedures used in the analysis of Al (99.99-98.0%), Zn (99.99-99.0%), and several alloys of these metals.

3111. BRETÓN, A. S.
Preparation and Purification of Carbon Electrodes for Spectral Analysis.

Anales real soc. españ. fís. y quím., 45A, 261-9; *Inform. quím. anal. (Madrid)*, 3, No. 6, 200-6 (1949).

C. A., 44, 2391g (1950).

A review with 20 references.

3112. BRODE, W. R. AND TIMMA, D. L.
Influence of Extraneous Elements on Line Intensity. IV. Extraneous-element Effects in the Direct-current Arc.

J. Optical Soc. Am., 39, 478-81 (1949).

C. A., 43, 6083f (1949).

The effect of varying amts. of extraneous element upon the line intensity of different elements has been investigated. Slavin's total-energy method (*C. A.*, 32, 7367*) was

used to make possible a more direct correlation than has been achieved with the internal-standard method. The results of this study indicate that the effect of the extraneous element varies with the amt. of extraneous element, but not in a simple linear fashion. The effect of an extraneous element on a group of lines of an element ending at the same energy level or beginning at the same energy level, is the same. The exptl. results show that the elements can be arranged in a series based on their inter-element effects in the d.-c. arc. An arrangement of the elements in a series based on their b.p.'s and excitation potentials is in agreement with that found experimentally.

3113. BRONSART, H. V.
Soluble Trace Elements in Hohenbockaer Glass Sand.

Z. Pflanzenernähr. Düngung u. Bondenk., 44, 119-21 (1949).

C. A., 44, 4084i (1950).

To det. the suitability of Hohenbockaer glass sand for use in sand cultures of plants, it was extd. with 1% citric acid and the ext. analyzed spectrographically. 15 elements could be detected in the ext., some in significant amts. These could not be removed by treatment of the sand with concd. HCl followed by ignition.

3114. BRUCELLE, G.
The Influence of the Energy of Discharge in a Spark Source on the Emitted Spectral Lines.

Congr. groupement avance. méthodes anal. spectrograph. produits mét. (Paris), 11, 29-40 (1949).

C. A., 44, 6719a (1950).

The relative intensities of spectrum lines are studied as a function of circuit parameters. (1) In a group of Fe alloys, the capacitance of the spark source was varied from 3000 to 9000 cm. at a const. voltage of 9000-10,000 v. With a few exceptions an increase in capacitance resulted in an increase in the intensity of that line having the higher ionization potential. Variations from this rule are identified as diffuse or reversed lines. (2) In a Duralumin alloy, the voltage was varied from 8000 to 12,000 v. and the intensity ratios of AlIII/AlII and AlIII/AlI lines were found to increase with increasing voltage. (3) The same Al line intensity ratios were found to decrease with increased inductance.

3115. BRYAN, F. R., NAHSTOLL, G. A., AND VELDHIJS, H. D.

Spectrographic Methods for Determining Magnesium in Nodular Iron.

ASTM Bull. No. 162, 69-72 (1949).

C. A., 44, 2888a (1950).

Standards are prepd. by the spectrographic soln. method, combining varying proportions of standard Fe and Mg solns. Bureau of Standards Sample No. 55b, Ingot Iron, dissolved in HCl and HNO₃, and solns. of MgSO₄·7H₂O are satisfactory. The electrodes, machined flat on the ends, are immersed in kerosene for 10 min., then surface dried. Three-hundredths ml. of soln. is placed on each electrode, which is then dried at 110° for 15 min. A spark exposure is used. A range of 0.01–0.10% Mg is covered. The range can be extended by varying the exposure time. For control analysis of nodular graphitic cast iron, pour the molten metal into iron or Mo molds to form $\frac{1}{8}$ -in. rod electrodes, which are ground to cone tips for sparking. A range of 0.005–0.15% Mg can be covered.

3116. BURKHART, L. E., STUKENBROEKER, G., AND ADAMS, S.

Isotope Shifts in Uranium Spectra.

Phys. Rev., **75**, 83–5 (1949).

C. A., **43**, 4136f (June 10, 1949).

A study was made of the isotopic shift of U²³⁸, U²³⁵, and U²³³ in the emission spectrum of U. Results are reported for 11 lines, 2565–4610 Å. Any line which shows a shift between U²³⁸ and U²³⁵ also shows a shift between U²³⁸ and U²³³. The direction of lighter isotopes is toward shorter wavelengths. There is no correlation between the amt. of shift and the at. wt. The concn. of U isotopes can be detd. by emission spectroscopic methods.

3117. BURRIEL-MARTÍ, F. AND RODRÍGUEZ PÉREZ, A.

Spectrographic Analysis of Silurian Rocks.

Anales edafol. y fisiol. vegetal (Madrid), **8**, 787–90 (1949).

C. A., **44**, 4835e (1950).

Two samples out of 16 had small amts. of Ba and Sr. Holzer's method was used.

3118. BURRIEL-MARTÍ, F. AND RODRÍGUEZ PÉREZ, A.

New Arc Electrode for Quantitative Spectral Analysis.

Anales real. soc. españ. fis. y quim., **45B**, 1395–1404 (1949).

Spectrochim. Acta, **4**, 311 (1950) (an abstract).

Oscillations of the arc and fractional distillation of the sample are avoided by using as lower electrode a 2-mm. diam. copper wire with a hole 1.5 mm. diam. and 1.5 mm. deep to contain the sample. The upper electrode may be 5 mm. or greater in diam. and should have a conical point. The arc is burned until the sample is completely consumed.

3119. BURRIEL-MARTÍ, F. AND RODRÍGUEZ PÉREZ, A.

The Use of Salt Mixtures in Spectrographic Determinations. III. Application to the Pairs Lead-tin and Lead-bismuth. *Anales real. soc. españ. fis. y quim.*, **45B**, 1501–12 (1949).

C. A., **45**, 60f (1951).

Numerical graphical data on the behavior of the pairs Pb-Sn and Pb-Bi in the alloyed state are compared with those obtained from the same pairs in the salt state (sulfate or oxide) in identical proportion. Variations in detns. on the alloys are 2 to 4 times those obtained for detns. on the corresponding salt mixts.

3120. BYLUND, K. G. AND RUDBERG, H.

A Simple Apparatus for Direct Reading by Spectrochemical Analysis.

Jernkontorets Ann., **133**, 507–18 (1949).

C. A., **44**, 2804a (1950).

Substituting a photocell for the customary photographic plate, and measuring directly the line intensities of the spectrum, the authors were able to carry out routine spectrographic detns. in only 3 min., with an accuracy equaling that of regular chem. analysis. The app. and the methods used are described.

3121. CABLE, L., LAPORTE, M., AND LE-GROS, R.

Estimation of Impurities in Gases.

French Patent 943,145, Feb. 28, 1949.

C. A., **45**, 986i (1951).

The gas, mixed if necessary with an inflammable gas, is burnt and the radiation of the flame measured with a photoelectric cell. By previously standardizing the cell and by using filters, amplifiers, etc., the amts. of various impurities are detd. The process is used to det. the dust content of blast-furnace gases (the photoelectric current varies linearly from 0.2–0.7 ma. as the dust content increases from 10–90 mg./cu.m.) and the benzene content of illuminating gas.

3122. CALKER, J. VAN, AND TACKE, E.

Time Dependence of the Spectral Character of Electric Sparks.

Z. Naturforsch., **4a**, 573–5 (1949).

C. A., **44**, 4325i (1950).

By means of a mirror, rotating out of phase with respect to the spark generator by an adjustable amt., intensity variations of spectral lines throughout the duration of single sparks were made visible. Lines corresponding to transitions originating from the same level vary similarly; in general, the higher the initial level of a spark line, the faster its decay. This is taken to mean that time-intensity changes depend more strongly on the optical excitation function than on the exciting mechanism. Emission of spark lines occurs primarily in the early part of the spark while excitation of arc lines begins later.

3123. CANDLER, C.
Practical Spectroscopy.
London: Hilger and Watts. (1949), 190 pp.
Reviewed in *Anal. Chem.*, 22, 198 (1950).
This book serves principally as an introduction to the use of the Hilger wavelength spectrometer and other Hilger equipment, and also serves as an introduction to general spectroscopy.
3124. CHECHIK, N. O.
Use of Photo Amplifiers in Spectral Analysis.
Uspekhi Fiz. Nauk, 37, 74-1113 (1949).
C. A., 43, 8297g (1949).
A crit. review; 72 references.
3125. COEUR, P. AND HANS, A.
Direct and Graphic Spectrum Analysis by Means of the Same Apparatus.
Rev. universelle mines, 92, 63-8 (1949).
C. A., 43, 3741i (1949).
A new app. is described which can be used for either direct or graphic analysis, or both. Results within 1% of the truth can be obtained in direct analysis in 55 sec. for the first element and in 5 sec. more for each addnl. element. With graphic analysis the error is somewhat larger but the time required is less.
3126. COEUR, P. AND HANS, A.
Photographic and Photoelectric Spectrochemical Analysis with the Same Apparatus.
Congr. groupement avance. méthodes anal. spectrograph. produits mét. (Paris), 11, 45-50 (1949).
C. A., 44, 6725b (1950).
A description is given of an A.R.L. direct-reading spectrograph modified to allow photographic recording in one order and photoelectric recording in another. Photoelec. reproducibility of better than 1% is reported on detn. of Mn (2933 Å) and Cr (2677 Å) in Fe (2368 Å).
3127. COLIN, R. H. AND GARDNER, D. A.
Determination of Alumina in Steel.
Anal. Chem., 21, 701-4 (1949).
C. A., 43, 7374i, (1949).
Al compds. in steel samples can be sepd. into acid sol. and acid insol. components. These are then analyzed spectrographically. After washing with Na_2CO_3 soln. to remove any remaining nitrides, the acid-insol. residue is fused and dissolved in a dil. acidic soln. Fe is added as an internal standard, and the soln. is slowly fed into a spark gap through a hollow C upper electrode. The spectrographic calibration is based on synthetic standards contg. 0.001-0.08% Al_2O_3 .
3128. COMENGE, M. AND DEÁN GUELBENZU, M.
Trace Element Metabolism in Herbivorous Larvae.
Abstrs. Communs. 1st Intern. Congr. Biochem., 1949, 105.
C. A., 46, 6764b (1952).
To det. why *Bombyx mori* larvae can be reared only on mulberry leaves they were fed leaves of *Broussonetia papyrifera*, *Maclura aurantiaca*, and *Ficus carica* and the metabolism of the trace elements was studied by spectrographic analysis. Larvae fed on the above leaves did not develop except for 2 individuals fed on *M. aurantiaca*. The trace elements that were found and chiefly mediate in the metabolism of *B. mori*, were: Ag; the respiratory metals Cu, Fe, Mn, Ni, and perhaps Co; and their catalyst elements Mo, Ti, and perhaps Zn. Al, Ba, Li, Pb, and Si were found but their importance was not ascertained.
3129. CUTTING, T. A.
Manual of Spectroscopy.
New York: Chem. Pub. Co. (1949), 226 pp.
Reviewed by W. F. Meggers in *Anal. Chem.*, 22, 199 (1950).
An elementary description of analytical spectroscopy.
3130. DAHLMAN, B. AND RYNNINGER, R.
Determination of Small Amounts of Uranium. V. Spectrochemical Determination in Solutions.
Svensk Kem. Tid., 61, 204-13 (1949)(in English).
C. A. 44, 974g (1950).
The spectrochem. method for impurities in steel (*C. A.*, 41, 663h) can be adapted to detg. U in pure uranyl nitrate solns. prepd. by ether extn. of impure U solns. Iron is suitable as the internal standard. Calibration curves are given. At low U content the accuracy is satisfactory, but for more than 5 mg. of U a gravimetric method is as good.
3131. DEHIO, H., EGGERT, J., HONERJÄGER-SOHN, M., HÖRMANN, H., AND KAISER, H.
Basic Reflections on the Problem of Plate Errors.
Spectrochim. Acta, 3, 488-97 (1949).
C. A., 43, 8276h (1949).
Factors which contribute to the photographic error of spectrochem. analysis are reviewed under 3 headings: errors of manipulation, defects of the emulsion, and graininess.
3132. DICKENS, J. AND PETIT, R.
Quantitative Spectrochemical Analysis of Bearing Alloys with the Use of Rotating Electrodes.

Congr. groupement avance. méthodes anal. spectrograph. produits mét. (Paris), 11, 25-7 (1949).

C. A., 44, 6766g (1950).

An analytical procedure is given for the detn. of impurities in Pb and Sn alloys. The sample is cast under molten KCN and chilled rapidly. The cast is in the form of a pair of disks 30-40 mm. in diam. with a 45° beveled edge. These disks are used as electrodes in the spark and are mounted with their axes at right angles. The disks are rotated during exposure by a pair of elec. motors connected to the electrodes by plexiglas shafts. The high voltage is passed to the disks through carbon brushes. The source used was a Feussner-type spark unit operated at 12,000 v. with an inductance of 80,000 cm. and a capacitance of 1800 cm. The lines used in the analysis are: Sn 2785 and 2661 Å; Sb 2652, 2670, and 2878 Å; Pb 2823, 2833, and 2873 Å, and Cu 2825 and 2961 Å for the Sn alloys and Pb 2628 Å with Sb 2670 Å, Cu 2961 Å, and Sn 2661 Å for the Pb alloys.

3133. DMITRIYEV, K. G.

Application of Interrupted Spark for Quantitative Spectral Analysis of Metals in Solutions.

Zavodskaya Lab., 15, 63-5 (1949).

C. A., 43, 5325h (1949).

An interrupted spark (55 breaks per min.) between 2 C electrodes the upper one being pointed, the lower one ground flat, and spaced by 4 mm. is fed with a filter paper impregnated by the test soln., which is pressed against the lower electrode and moved after each spark interruption. The app. was used for detg. Mg in the presence of Cu and Ni, with the sample dissolved in 7.5 N HNO₃. The soln. was evapd. and dild. with water. Usually 20-60 interruptions are sufficient for satisfactory exposure, with the 2852.1 Å line used for Mg. The app. was also used successfully for detg. Al, Fe, Mn, Mg, and Cu in natural waters.

3134. DOBRINSKAYA, A. A. AND SEL'YANIN-OVA, E. P.

Sorting Pobedites with the Steeloscope.

Zavodskaya Lab., 15, 1480-2 (1949).

C. A., 46, 851g (1952).

Line-pairs are given for the detn. of Ti, Co, Ni, and Mo in this W-base cermet, by means of a Cu counter-electrode and a triggered a.-c. arc.

3135. DOMINGO, W. R. AND KLYNE, W.

Photoelectric Flame Photometer.

Biochem. J., 45, 400-8 (1949).

C. A., 44, 3067f (1950).

Construction and operation of the instrument are described. Na and K detns. in plasma and urine are discussed.

3136. DOORSELAER, M. VAN, EECKHOUT, J., AND GILLIS, J.

Spectrochemical Analysis of a Solution on Graphite.

Congr. groupement avance. méthodes anal. spectrograph. produits mét., 12, 51-7 (1949).

C. A., 45, 4168f (1951).

Factors which affected bronze analysis according to the method of Rivas (cf. *C. A.*, 32, 1601¹) were studied. When adsorption of the soln. on graphite took place at a temp. above 100°, the sensitivity of spectral lines was at a max. and their relative intensities were const. An increase in the concn. of the soln. gave a greater sensitivity, except in the case of some elements such as Al, but did not influence the relative intensities. The effect of the vol. of the soln. on the electrode was negligible. A change in the anion ratio of a soln. produced changes in the spectra because of differences in the volatility, as well as adsorption and absorption characteristics of various salts and their complexes. The presence of colloidal Sn gave abnormally high results.

3137. DUNABIN, J. E., MASON, H., SEYFANG, A. P., AND WOODMAN, F. J.

Spectrographic Examination of Chromatographic Columns.

Nature, 164, 916 (1949).

C. A., 44, 2403i (1950).

With Al₂O₃ as adsorbent, the dithizone complexes of a no. of metals were sepd. chromatographically and sections were examd. with an ultraviolet spectrograph. Quantities of Cd between 0.1 and 0.5 γ could be detd. with a standard deviation of 10%. This represented concns. of 0.02 to 0.1 ppm. on a 5-g sample.

3138. EECKHOUT, J.

Quantitative Spectrochemical Analysis of Chromium-nickel [18/8] Steel, by Using Solutions and a Hilger Medium Spectrograph.

Anal. Chim. Acta, 3, 377-82 (1949) (in English).

C. A., 43, 8965b (1949).

Working conditions are described for the spectrochemical analysis of 18/8 steels, by using solns. and a spectrograph of moderate dispersion. The technique is based on the method of Scheibe and Rivas (*C. A.*, 30, 6302⁷), with Pfeilsticker's interrupted a.-c. arc (*C. A.*, 35, 6211⁷); *Z. Elektrochem.*, 43, 719 (1936); *Z. Metallkunde*, 30, 211 (1938) as a source unit. Analysis lines are given for the detn. of Cr, Ni, Mn, Mo, Ti, Cu, and Cb.

The av. deviation for one exposure varies from 4 to 9% for the different elements. The accuracy is less than in the case of pure C steel.

3139. Eeckhout, J.

Spectrographic Analysis of Slags by Using Spark Technique.

Spectrochim. Acta, **3**, 575-83 (1949).

C. A., **43**, 8307e (1949).

A method is described for the spectrographic analysis of slags. A high-voltage condensed spark excitation is used with powd. samples on a flat pure graphite electrode. Calibration curves have been prep'd. both for the detn. of percentage of different elements in slags, with CuO as an internal standard, and for the detn. of oxide/silica ratios, by using a mixt. of sample with pure graphite. The method gives sufficient accuracy for slag control, and results obtained for several elements prove more reliable than those of routine chem. analysis.

3140. EMARA, M. AND SOLIMAN, M. A.

Applications of the Methods of Assay for Thallium in Toxicological Analysis.

J. Roy. Egyptian Med. Assoc., **32**, 895-905 (1949).

C. A., **44**, 5263i (1950).

Methods for detg. Tl in toxicological analysis were studied in view of the recent extensive use of TIOAc for the treatment of ringworm of the scalp with occasional toxic symptoms and fatal results. The method of Fridli (cf. *C. A.*, **28**, 3131⁹) was found to be the easiest and most reliable for toxicological purposes. The method consists of four steps: (1) Macerate the tissue with HCl and KClO₄, filter, ext. filtrate with ether, evap. ether, and extract residue with H₂O. (2) Ppt. Tl as TlI and oxidize to TlBr₃ with Br water. (3) Liberate I by addn. of excess KI. (4) Det. I by titrating with 0.005 N Na₂S₂O₃ with starch indicator. The aq. soln. resulting from step 1 can also be exam'd. spectrographically for the presence of Tl.

3141. ENNS, J. H. AND WOLFE, R. A.

An Air Interrupter Type Spectrographic Light Source.

J. Optical Soc. Am., **39**, 298-304 (1949).

The principle feature of this source is an air interrupter, some of whose operating characteristics have been described in two earlier papers. This paper presents a general technical description of the source to illustrate its unusual flexibility. A procedure followed in selecting source parameters is outlined. Experimental data presented are those obtained by the usual photographic method and from direct recording type time-of-wait curves. Several examples are given to show the most suitable source conditions for some widely different type samples.

3142. EUBANK, W. R. AND BOGUE, R. H.

Flame Photometer for Determination of Sodium Oxide and Potassium Oxide in Portland Cement.

J. Research Natl. Bur. Standards, **43**, 173-82 (1949) (Research Paper No. 2019);

Portland Cement Assoc. Fellowship at Natl. Bur. Standards, Paper No. 54.

C. A., **44**, 8611i (1950).

For detn. of Na₂O and K₂O in portland cements and in raw materials of cement, such as limestones and clays, studies are made with the Perkin-Elmer model 52-A flame photometer. It is essential to calibrate the instrument with solns. of NaCl and KCl of known concns., for each type of material to be analyzed. Comparative detns. of Na₂O and K₂O are carried out by a gravimetric method (I), emission photometry with Li₂O being used as an internal standard (II), and by emission photometry by the direct intensity method (III) with CaO-HCl solns. contg. known amts. of Na₂O and K₂O for calibration. The av. of the differences between I and III were 0.012% for Na₂O and 0.024% for K₂O, for the usual range of Na₂O and K₂O contents (0.2 to 0.8%) of the samples. The results of II check even more closely with I but may be less reliable since the original samples may contain small amts of Li₂O.

3143. EVERLING, W. D.

Improved Spectrographic Power Source.

Steel, **124**, No. 20, 80-1, 116 (1949).

C. A., **43**, 4905a (1949).

A compact unit is described which provides a high-voltage spark and a spark-ignited a.-c. arc, with air-interrupter control and with an oscilloscope to observe discharge conditions.

3144. FASSEL, V. A.

Quantitative Spectrographic Analysis of the Rare-earth Elements. III. Determination of Major Constituents in Complex Mixtures.

J. Optical Soc. Am., **39**, 187-93 (1949).

C. A., **43**, 2889a (1949).

A method is described for detg. Y and Gd in complex mixts. in the concn. range 8-100%. The procedures involve the high-current d.-c., arc, excitation of mixts. of rare earth oxide-ceric oxide, and graphite. Selected lines of Ce are used as internal standards. The choice of Ce as internal standard was based on the relative ease with which any Ce if present in a mixt., could be sep'd. from the mixt. and then introduced to a definite extent. Precision studies showed a standard deviation of about $\pm 2.5\%$ for single detns.

3145. FELDMAN, C.

Direct Spectrochemical Analysis of Solutions.

Anal. Chem., **21**, 1041-6 (1949).

C. A., **43**, 8945b (1949).

The porous cup electrode consists of a 3 × 38 mm. right cylindrical graphite rod, with a 3-mm. hole drilled along its axis from one end to within approx. 1.1 mm. of the other end. It is used as the upper electrode, with the open end up. A long-hosed pipet contg. the soln. to be analyzed is inserted into the electrode cavity until its tip touches bottom; the soln. is then expelled as the pipet is withdrawn. The lower electrode is a solid 3-mm. graphite rod. A synchronous spark from a Baird spark source or a 220-v. intermittent a.-c. or d.-c. arc is first applied for 5 or 10 sec., with a 2-mm. analytical gap. The heat thus produced helps the liquid to soak through the bottom of the porous cup and reach the sparking surface. After a ~15-sec. rest, the sparking is resumed and the exposure begun. The thin surface film of liquid, continuously being dissipated by the spark, is renewed by capillarity; spattering does not occur, as the spark never strikes the body of the liquid. The soln. does not boil over at moderate power levels. Acidic, neutral, and slightly alk. solns. having a wide range of salt concns., as well as many org. solns., can be analyzed by this technique. A table of sensitivity limits is presented.

3146. FELDMAN, C.

Note on the Arc Spectrum of Element 61. *J. Am. Chem. Soc.*, 71, 3841-2 (1949). *C. A.*, 44, 9797e (1950).

The arc spectrum of 3 samples of the chloride of element 61 was examd. The strongest arc lines in the 3000-3450 Å region are: 3366.05 weak, 3377.64 weak, 3391.25 medium, 3418.67 weak, 3427.42 strong, 3441.09 weak, 3449.81 medium. All lines are ± 0.03 Å.

3147. FELDMAN, C.

Spectrochemical Determination of Hafnium-zirconium Ratios. *Anal. Chem.*, 21, 1211-15 (1949). *C. A.*, 44, 475f (1950).

Detailed directions are given for using the porous cup method (*C. A.*, 43, 8945b) to detn. Hf/Zr ratios in solns. in which 100 Hf/Zr = 0.07 to 9.3 by wt., with and without the use of pure Hf and Zr compds. The accuracy of corrections for faint backgrounds is increased by (a) pre-fogging the emulsion in the region of interest, and (b) using the Seidel function (*C. A.*, 40, 2737³; 42, 7637f) rather than the H and D function, for calibrating the emulsion.

3148. FILIMONOV, L. N.

The Nature of the "Flare-ups" of Lines of Spectra in Voltaic Arc. *Zavodskaya Lab.*, 15, 688-91 (1949). *C. A.*, 44, 423h (1950).

Connection of sample C as the cathode leads to more frequent flare-ups due to more frequent shifting of the arc site than is the case

with the anode, on which the oxides forming a surface film tend to restrict the motion of the arc.

3149. FILIMONOV, L. N.

The Sparking-off Effect and the Influence of Third Elements in Spectral Analysis. *Zavodskaya Lab.*, 15, 1178-93 (1949). *C. A.*, 46, 5479i (1952).

The relative volatilities in an intermetallic spark discharge, and thus the relative intensities of their spectral lines, are affected by their states of chem. combination at the sparking surface during the discharge. If the affinities of metals A, B, and C for O increase in the order $A < B < C$, the addn. of C to an AB alloy will increase B/A intensity ratios in exposures made after the sparking-off period; otherwise, it will decrease them. Sparking off decarburizes the surface layer of a metal, thus diminishing any possible effects of initial differences. Annealing cast iron causes deposition of graphite, lowering the C concn. in the metal, and thus lowering the Si/Fe intensity ratios. Nitridization of a steel surface depresses metal/Fe intensity ratios.

3149a. FILIMONOV, I. L. N.

Effects of Sparking and of Third Elements in Spectral Analysis. *Zavodskaya Lab.*, 15, 919-36 (1949). *C. A.*, 47, 3171e (1953).

An extensive review and discussion of the literature is followed by exptl. work to det. effects of O and oxidizing and reducing atm. on sparking curves of steels. The usual method does not permit recording of the initial portion of sparking curves; to accomplish this, the surface being sparked was increased by rotating the disk sample so that the sparking surface was either the rim of the disk or the ring on a plane surface of the disk. Two types of curves were obtained: one for Si, Cr, Mn, and Al and another for Cu, Ni, and Co. The structure and significance of the curves are discussed. 25 references.

3150. FRICK, G.

Spectral Analysis in the Industrial Laboratory. *Bild u. Ton*, 2, 238 (1949). *Chem. Zentr.*, 1950, I, 319. *C. A.*, 46, 9011b (1952).

The use of the rapid spectral analytical method of Closs (cf. *C. A.*, 33, 8141²) is described. The spectra of pure metals or of standard solns. of known concn. are photographed and the negs. so obtained are used as filter plates. When such a neg. is placed over the exptl. plate the lines of the particular metal or soln. are filtered out and the deviations in the exptl. plate can be readily detd. The rapid method of Jaenicke (cf. *C. A.*, 34, 6889⁴) is recommended for the development of

the plates. The single-bath developer contains KOH 60, hydroquinone 30, and Na_2S 25 g., phenosafranine soln. (1:1000) 20 cc., and water to make 1 liter. Bath temp. is 18–20°. The immersion period is 15–25 sec. The plates are washed under rapidly flowing water for 5–10 sec. For the 2-bath developer the following two solns. are used: In the 1st bath 50 g. hydroquinone is dissolved in distd. water and dild. to 1 l., then 20 cc. of 1:1000 phenosafranine soln. is added. The bath temp. is 26°, and immersion period is 7–8 sec. The plates from this bath are not washed. The 2nd bath is a NaOH soln. contg. 300 g./l. The development takes place in this bath. The immersion period is 2 sec., and the plates are washed for 5–10 sec. in rapidly flowing water. The fixing bath contains 400 g. $\text{Na}_2\text{S}_2\text{O}_3$ and 20 g. NaHSO_3 per l. The immersion period is 1–2 min. depending upon the type of plate. The fixing time can be shortened by increasing the bath temp. A plate which becomes clear in 60 sec. at 18° will clear in 30 sec. at 30°. Fresh fixing baths fix more slowly than those which have been mixed for some time.

3151. FRISH, S. E. AND SHREIDER, E. Y.
High-frequency Discharge as a Light Source for the Spectral Analysis of Gases.
Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., 13, 464–72 (1949).
C. A., 44, 1325g (1950).

Spectral gas analysis is made difficult because in a low-pressure arc discharge the electron temp. depends on the compn. of the gas. Therefore in a mixt., gases with low activation and ionization potentials will be more strongly excited. Chem. reactions and adsorption at the walls may also take place, changing the compn. Both conditions can be improved by using a "step" excitation in tubes with capillary restriction and c.d. of several amp. $\times 10/\text{sq. cm.}$ and by employing outside electrodes and a high-frequency generator with $\lambda = 9\text{--}100\text{ m.}$ (the tests were made $\lambda = 27\text{ m.}$). The discharge tubes were made of fused quartz; they had a set of capillaries of decreasing section in series. Calibration was made with mixt. of gases of known compn. and a step filter with known transmission ranges. The probable error of each reading was 2.5–5%. This method can be used in the analysis of gases showing chem. changes under gas discharge. As an example a mixt. of N_2 and CO_2 was investigated which showed bands of N_2 , CO , and CN . As analytical pairs were selected $\text{CN}\lambda = 3880\text{ \AA}$ and $\text{CO}\lambda = 4124\text{ \AA}$; $\text{N}_2\lambda = 3998\text{ \AA}$ and $\text{CO}\lambda = 4124\text{ \AA}$; $\text{N}_2\lambda = 3998\text{ \AA}$ and $\text{CO}\lambda = 4392\text{ \AA}$. The calibrations were made at 0.35 mm. pressure, 350 ma. current, a 5-mm. diam. of the capillary tube, 2–3 min. of exposure and N_2 concns. of 0.5–25%. If instead of a capillary

an L-shaped tube was used and the electrodes were applied to both ends of the L, the character of the discharge coming lengthwise from the horizontal leg was different from the light coming from the central portion. A high-frequency ring discharge was also tried.

3152. GASSMANN, A. G. AND O'NEILL, W. R.
Spectrographic Determination of Phosphorus and Metals in Lubricating Oils, Using a Porous Cup Electrode.
Anal. Chem., 21, 417–18 (1949).
C. A., 43, 4840f (1949).

When the upper electrode is made in the form of a cup with a bottom 0.635 mm. thick and the oil placed in it, reproducible results for P and other metals can be obtained with different base oils. The lower electrode was sharpened to a 45° angle cone. Only 1 ml. of oil was required in the top porous cup, and of this only 0.35 ml. was consumed during sparking. A spark was used for excitation with 5-microfarad capacitance and residual inductance and resistance. The background around the P line was used as the internal standard when the line intensity was corrected for this. An av. deviation of 6.8% of the P present was obtained. Ba, Ca, and Zn were detd. by the same technique.

3153. GATTERER, A. AND JUNKES, J.
Atlas of Persistent Lines. III. Spectra of Rare Metals and Some Metalloids.
Specola Vaticana, Vatican City (1949).
Charts of spectra between 2100 and 6430 Å for Au, Cb, Re, Sb, Ta, U, As, Be, Ga, Ge, In, Te, Ru, Rh, Pd, Os, Ir, Pt, Cl, Br, I, S, Se, Hg, and Hf. Reviewed in *Spectrochim. Acta*, 4, 177 (1950).

3154. GERLACH, W. AND RIEDL, E.
Die chemische Emissionsspektralanalyse. T. III. Tabellen zur qualitative Analyse. 3rd ed.
Leipzig: Johann A. Barth. (1949), 154 pp.

Wavelength tables are presented for spectrochemical identification of the elements. The main table gives for each of 57 elements the wavelengths (to 5 figures) of two to nine strongest lines, the elements and their wavelengths which may interfere with the analysis, and control lines of the interfering elements. Since these tables are designed for use with small prism spectrographs wavelengths differing less than 6 Å are regarded as coincident. The total number of analysis lines for 57 elements is 360 ranging in wavelength from Zn_I 2138.5 Å to Cs_I 8943.6 Å. In minor tables the wavelengths of 101 analysis lines of 14 rare earths (including La & Hf), and of 118 analysis lines of 16 non-metals are given.

3155. GILLIS, J. AND BECKHOUT, J.
Spectrochemical Practice.

Mededel. Koninkl. Vlaam. Acad. Wetenschap., Belg., Klasse Wetenschap., 11, No. 9, 5-20 (1949).
C. A., 44, 6330h (1950).

A new technique for analyzing a powder is described. A weighed sample is pulverized in an agate mortar with a little EtOH, and the mixt. stirred until the alc. is evapd. More EtOH is added to form a homogeneous suspension, which is applied to the graphite electrode by means of a glass tube of the same diam. as the electrode. As the alc. evaps., it leaves the electrode uniformly coated with the suspended powder. Spectrochem. analysis can then be conducted either with a spark or the intermittent arc, although most satisfactorily reproducible results are obtained with the spark. The results of spectrochem. analysis can be improved by passing a current of air between and symmetrically around the electrodes. The use of the logarithmic step sector with an intermittent source has been found to be unsatisfactory in analyzing powders.

3156. GILLIS, J. AND BECKHOUT, J.
 Use of the Logarithmic Step-sector with Rapidly Interrupted Light Sources in Spectrochemical Analysis.
Mededel. Koninkl. Vlaam. Acad. Wetenschap., Belg., Klasse Wetenschap., 11, No. 12, 5-10 (1949).
C. A., 44, 7707h (1950).

Stroboscopic effects are easily observed when a high-speed step-sector is used with an intermittent light source. By synchronizing the rotation of the sector with the interruption of the arc (i.e., slow-speed sector) calibration curves satisfactory for the analysis of steels were obtained by using sufficiently long exposures; for the analysis of clays this procedure still gave unsatisfactory results and the slow-speed sector method was abandoned. The high-speed (750 rpm.) sector with normal exposures introduces no deviation with a continuous arc source; there is some deviation with the spark, and considerable deviation with the interrupted-arc source. The use of a step-sector with any kind of interrupted source is not recommended, even if the exposure time is increased.

3157. GILLIS, J. AND BECKHOUT, J.
 The Spectrochemical Analysis of Clays.
Congr. groupement avance. méthodes anal. spectrograph. produits mét. (Paris), 11, 69-80 (1949).
C. A., 44, 7034g (1950).

Several spectrochem. procedures are given: (1) the clay to be analyzed is powd., mixed with an equal part of graphite and placed in a graphite rod having an annular hollow in its end. The sample is run for 45 sec. in a

10 amp. d.-c. arc. For the detn. of Al, Fe, Ti, Ca, and Mg, the reference line Si 2631 Å is used. For the detn. of Na and K, $1/10$ part Li_2CO_3 is added, and the Li used as a reference material. The reproducibility is 10-15%. (2) For spark analysis 4 parts Cu are mixed with 1 part clay. The mixt. is suspended in a small amt. of alc. (1 ml./0.1 g.) and a drop of the suspension is deposited on the flat surface of the lower graphite electrode. Errors of 3-5% are reported. Fe_2O_3 , TiO_2 , CaO, and MgO are detd., but Na and K and the lower concns. of the other elements cannot be detd. (3) A soln. method is described in which the clay is dissolved in H_2SO_4 -HF and evapd. to dryness. The sulfate is redissolved in HCl and again evapd. The residue is mixed with a soln. contg. 2.5 g. of Cu as CuSO_4 per 100 ml. soln. of 2 N HCl. A drop of the soln. is placed on the lower C electrode and evapd. to dryness. Exposure is by intermittent arc. The following detns. are reported: Al_2O_3 , 1.0-50%; Fe_2O_3 , 0.1-20%; TiO_2 , 0.1-3%; CaO, 0.1-3.0%; MgO, 0.01-3.0%; and Na_2O , 1.0-3.0%.

3158. GIRSCHIG, R.
 Application of Statistical Methods to Spectrographic Analysis.
Rev. mét., 46, 719-26 (1949).
C. A., 44, 1844c (1950).

Results of spectrographic analysis may be influenced by conditions of excitation, position, and dimension of electrodes, irregularities of photographic plates, errors in measurements, etc. Their total effect shows itself in a scattering of the results. Application of probability curves is described which permits the sepn. of values obtained in operations under control from those which are erratic. It also helps to det. the proper operating conditions. A method is given for finding whether a given group of results presents normal or abnormal values and the degree of precision of detns.

3159. GROSSMAN, H. H., PETERSON, E. W., SAUNDERSON, J. L., AND CALDECOURT, V. J.

Optical and Electrical Alterations to a Michigan Microphotometer.
J. Opt. Soc. Am., 39, 261-3 (1949).

A microphotometer of the type described by Vincent and Sawyer has been altered optically and electrically to eliminate certain objectionable features. Scattered light, dependence of the plate projection lens upon the aperture of the plate illumination system, photo-cell fatigue, relatively short life of the projection lamp, and the need for a constant voltage power supply have been eliminated. Plate calibration curves obtained with the altered instrument on wide bands and narrow lines are essentially identical.

3160. GUNN, E. L.

Metallic Contaminants in Fluid Cracking Catalyst.

Anal. Chem., 21, 599-602 (1949).

C. A., 43, 8655i (1949).

The emission spectrograph has been routinely applied to the analysis of alumina-silica catalysts for traces of Fe, Na, Ca, Ni, Cr, and W. It is much faster than chemical methods (also described) and precision of results is as good or better. With the spectrograph, Co, W, and Sr salts are used as internal standards; selected lines of Co for Fe, Ni, V, and Na; W for Cr; and Sr for Ca. Line pairs are listed, and typical density ratio-concn. curves are illustrated. Equipment and standard conditions of operation are described.

3161. GUSYATSKAYA, E. V. AND RUSANOV, A. K.

Spectroscopic Determination of Small Quantities of Beryllium in Solutions and in Aluminum-magnesium Alloys.

Zhur. Anal. Khim., 4, 80-3 (1949).

C. A., 44, 477c (1950).

For detg. small quantities of Be in soln. a Feussner spark was used and a specially constructed lower electrode. The latter comprised a brass rod inserted in a glass tube. The tube flared upwards and to it was joined a glass thimble for the analyzed soln. A Pt wire extended from the brass rod through the bottom of the thimble. Inside the thimble the wire was fashioned in the shape of a clip over which was inserted a hollow graphite cylinder 13 mm. high and 13 mm. diam. which acted as the lower electrode. The amt. of Be was detd. from the difference in darkening between the Be line 2348.61 and the Cd line 2288.02 Å. The Cd was introduced as an internal standard. To det. Be in Al-Mg alloys, dissolve a 0.1-g. sample in HCl. Test as above but if the Al content is known, the relative intensities of Be 2348.61 and Al 2367.06 and 2373.13 Å can be used.

3162. HALE, A. C.

Spectrographic Analysis by Copperweld.

Elec. Furnace Steel Conf., Am. Inst. Mining Met. Engrs., *Proc.* 7, 124-5 (1949).

A note in which the application of a large Littrow quartz spectrograph to the analysis of steel is discussed. The elements determined are Mn, Si, Cr, Ni, No, Cu, Sn, Al, W, V, Pb, Ti, and B in concentration ranges not exceeding 2.5%. The installation of a direct-reading spectrometer is mentioned.

3163. HALLMAN, N. AND LEPPÄNEN, V.

Flame-photometric Determination of Potassium and Sodium in Biological Fluids.

Suomen Kemistilehti 22B, No. 11, 55-60 (1949) (in English).

C. A., 44, 10031e (1950).

A comparative flame photometer on the model of that of Wallace (*Am. J. Diseases Children*, 77, 104 (1949)) was built for detn. of K and Na, by using a const. quantity of Li added to the unknown soln. as an internal standard (Berry, *et al.*, *C. A.*, 40, 2083^a). Limits of error in serum detn. were $\pm 1.81\%$ for Na and $\pm 1.98\%$ for K. Serum or plasma Na can be detd. from 0.1 ml. and K from 0.2-ml. sample.

3164. HANS, A.

Application of the Method of Photometric Line Width Measurement to the Analyses of Zinc, Iron, and Steel.

Congr. groupement avance. méthodes anal. spectrograph. produits mét. (Paris), 11, 51-5 (1949).

C. A., 44, 6764d (1950).

A method of quant. spectrochem. analysis is described. In each alloy, the width of the minor constituent lines are measured at the intensity level of the max. of a weak line in the spectrum of the base metal. The advantage claimed for this method lies in the wide range of concn. that can be handled with a single exposure. Curves are given for Pb in Zn for Pb concn. ranging from 0.001 to 3%. Tables are presented of the analyses of Zn for Pb, Cu, Sn, Cd and steel for Mn, Si, Ni, Cr, Cu, Sn, and B and Fe for Mn and Si.

3165. HANS, A.

Several Methods of Calibrating Photographic Emulsions.

Congr. groupement avance. méthodes anal. spectrograph. produits mét. (Paris), 11, 57-60 (1949).

C. A., 44, 6724i (1950).

A review of current techniques of plate calibration for quant. spectrochem. analysis. The following are covered: (1) Churchill's method of utilizing calibration filters (*C. A.*, 39, 880^a); (2) calibration by means of a series of Fe lines whose intensity ratios have been previously detd; (3) calibration by means of a single line, half of whose length passes through a filter; and (4) calibration from the profile of a single line by using a previously prepd. characteristic curve.

3166. HANS, A.

Application of Direct Analysis to the Analysis of Steel and Thermal Zinc.

Congr. groupement avance. méthodes anal. spectrograph. produits mét., 12, 105-12 (1949).

Institut pour l'Encouragement de la Recherche Scientifique dans l'Industrie et l'Agriculture de Bruxelles, 1, 77-95 (1949).
C. A., 45, 3760d (1951).

A grating spectrograph was adapted to the use of an electron multiplier tube for direct analysis and a camera for graphic analysis either simultaneously or alternately. A direct analysis of steel for Mn, Si, and Cr was reproducible to within 0.6 to 0.8% and a simultaneous photographic analysis varied from 1.5 to 1.85%. P_{2515-8} and P_{2515-3} were used for the detn. of the order of 0.005% with an av. quadratic error of 6 and 7% resp. The phys. state of the samples and chem. heterogeneity introduced errors which were minimized by using standards similar to the sample to be analyzed. Control analyses of Pb and Fe in thermal zinc by this method were carried out in about 22 sec.

3167. HARRISON, G. R.

The Production of Diffraction Gratings:
II. The Design of Echelle Gratings and Spectrographs.

J. Opt. Soc. Am., 39, 522-8 (1949).

In seeking to circumvent the difficulties that have limited production of ruled gratings having resolving powers in excess of 400,000 it is observed that resolving power at a given wavelength depends only on the ruled width of the grating and the angles of illumination and observation, and not specifically on the number of ruled grooves. The reflection echelon is a grating of high resolving power in which groove separation has been increased to a degree involving extreme sacrifice of free spectral range. It is suggested that much could be gained by producing a grating with only as many reflecting grooves per inch as are needed to give sufficient free spectral range to avoid difficulties arising from overlapping of orders. For the study of Zeeman effects, hyperfine structure, and complex atomic and molecular spectra, 20 wave numbers of free spectrum should suffice, which would require use of about 100 grooves per inch. Such gratings, having a simple step groove form that reflects light of all orders in a narrow bundle, and designed to be used at an angle of incidence greater than 45° and normal to the narrow side of the "step," may be designated "echelles," as intermediate in character between the echellette and the echelon. Echelles should lend themselves to production of very powerful compact spectrographs giving single-exposure coverage of broad spectral ranges. A 10-inch echelle having 1000 grooves of width 0.25 mm., each with one flat side 0.05 mm. deep, gives at 5000 Å a theoretical resolving power of one million, a free spectral range of 5 Å and a plate factor of 0.2 Å/mm., when used with a lens or mirror of only 250 cm. focal length. It should thus be as powerful as a 10-inch concave grating of 42 ft. radius having 30,000 grooves per inch when used in the third order, and would be much faster even though used with a lens of less

than 75 mm. aperture. When crossed with a suitable prism or grating of low dispersion this echelle should, without overlapping of orders, produce spectrograms having a range of 10,000 wave numbers or more on a single plate, instead of the 5 to 25 plates required by the equivalent orthodox grating in the Paschen-Runge mount. The echelle spectrograph would also offer great gains in stability and portability. Problems and possibilities of the production of original and replica echelles are discussed, and it is shown that the reduction of ruling time from weeks to hours makes interferometric control of groove spacing in gratings appear feasible for the first time.

3168. HASLER, M. F.

Precise Analysis of High-alloy Steels by a Direct Reading Process.

Congr. groupement avance. méthode anal. spectrograph. produits mét., 12, 113-22 (1949); cf. *C. A.*, 37, 3339^a.

C. A., 45, 3759d (1951).

A direct reading Quantometer is described which gives a precision that compares favorably with that obtained by good chem. methods in the analysis of the major components of steels. The concn. of these components can be calcd. by a direct method. A damped discharge, such as that furnished by the Multisource, eliminated the complimentary interaction between elements.

3169. HASLER, M. F.

Direct Reading Analysis of Low Alloy, Tool, and Stainless Steels with the Quantometer.

Instruments and Measurements Cond., Stockholm, *Trans.*, 1949, 13-15 (in English).

C. A., 45, 7469c (1951).

A description is given of a method of analyzing steels with the quantometer. Spectra of the samples are excited by a Multisource Unit. Errors in analysis of about 0.1% of the quantity being measured are realized. Typical analyses are shown for an 18-8 and a tool steel. Cf. *C. A.*, 42, 8538a; 45, 3759d.

3170. HASLER, M. F.

Direct-reading Analysis of 18-8 Stainless Steels.

Iron Age, 164, No. 18, 96-9 (1949).

C. A., 44, 482i (1950).

Development of the multiplier phototube as a light-measuring device makes possible improvements in precision and speed of analysis and removes the contents limitation of not more than 5%. Successful application of the improved technique to the analysis of 18-8 stainless steel is described.

3171. HEGEMANN, F.

The Origin of Molybdenum, Vanadium, Arsenic, and Chromium in Wulfenite of the Alpine Lead-zinc Deposits.

Heidelberg. Beitr. Mineral. Petrog., 1, 690-715 (1949).

C. A., 44, 491d (1950).

To solve the problem of whether wulfenite was deposited by primary hydrothermal solns. or by superegene processes, spectrographic analyses were made of 6 wulfenite, 1 vanadinite, and 1 descloizite samples. These showed appreciable amts. of V and As, and the 2 V minerals contained Cr, Cu, and Ni as well. No Mo or V was found in galena, sphalerite, pyrite, or marcasite from the ore, or in 6 samples of the limestone gang. The bituminous oölite overlying the ore showed an av. of Mo 0.02, V, 0.035%, also Ni, Cr, Cu, Co, Ni, Ti, Mn, and Sn. Therefore the wulfenite is of secondary origin, being derived from leaching of the overlying rock.

3172. HERDLE, A. J. AND WOLTHORN, H. J.
Silica Refractories. Spectrographic Analysis with a Controlled Multisource Power Unit.

Anal. Chem., 21, 705-7 (1949).

C. A., 43, 7656b (1949).

Refractory materials contg. approx. 95% SiO₂ are analyzed spectrographically. The sample is pulverized to pass a 100-mesh screen and pressed into a center-post, crater-type, C lower electrode. The upper electrode is a pointed C with slightly rounded tip. A high-capacity overdamped condenser discharge is used. Si lines are used as internal standards. Oxides of the following are analyzed over the range indicated: Ca, 1-4; Al, 0.3-1.75; Fe, 0.2-1.0; Mg, 0.05-0.30; Ti, 0.05-0.20; K, 0.01-0.5; and Na, 0.03-0.35%. Na and K analyses show standard deviations of 12 and 14.3%, resp. Standard deviations of 3.4-5.8% are reported for the other elements.

3173. HÉROS, M.

Spectral Analysis.

Chim. anal., 31, 131-6 (1949).

C. A., 43, 6103h (1949).

This is the first installment of a review.

3174. HOLM, R.

The Vaporization of the Cathode in the Electric Arc.

J. Appl. Phys., 20, 715-6 (1949).

Spectrochim. Acta, 4, 255 (1950).

Calcs. show that, because of the smallness of the cathode spot, the cathode is not able to dissipate the heat generated by heavy currents by conduction. Consequently a much greater vaporization of cathode material per coulomb occurs for higher than for lower

currents. Curves are plotted for C, Cu, and W.

3175. HONERJÄGER-SOHN, M. AND KAISER, H.

The Scattering of Intensity Ratios of Spectral Lines Measured Photographically.

Spectrochim. Acta, 3, 498-517 (1949).

C. A., 43, 8276i (1949).

In routine analysis it was found that the density differences for a pair of lines of const. relative intensity were different on different plates, and that the variability of this difference is related to the geometrical distance between the line images. The variability on a single plate is much less affected by the distance between the lines. The cause of this variation is traced to nonuniformity of development and partly to nonuniformity of emulsion coatings. The consequences of this for routine spectrographic analysis with permanent calibration curves are discussed, and mechanized development techniques are recommended.

3176. HUGHES, H. K., ANDERSON, J. W., MURPHY, R. W. AND RATHER, J. B., JR.
Rapid Analyses by Means of Emission Spectroscopy.

Proc. Am. Petroleum Inst. III, 29M, 89-102; discussion, 102-3 (1949).

C. A., 44, 4659i (1950).

The app. and procedures are described that are used in routine semiquant. and quant. spectroscopic analysis of oils, sludges, greases, metals, and bearings in a petroleum lab. Twenty-six elements are reported on routine analyses, 22 on special request, and 5 other elements require special handling.

3177. HUGHES, H. K. AND MURPHY, R. W.
Emulsion Calibration Scale for Quantitative Spectroscopic Analysis.

J. Optical Soc. Am., 39, 501-4 (1949).

C. A., 43, 6006g (1949).

The time devoted to collecting and plotting emulsion calibration data can be reduced considerably by the use of a new transmittance scale which is logarithmic from 1 to 30% and which then expands nonuniformly to 97%. Data are presented from 7 independent labs. which establish the approx. linearity of the emulsion calibration curves for Eastman SA-1 films, SA-1 plates, SA-2 films, I-N plates, and 33 plates. The practical uses of this scale on plotting boards and in a special emulsion calibration paper are discussed. In certain cases, all emulsion calibration procedures can be eliminated. A transmittance slide rule for use in the quant. detn. of tetraethyl lead in gasoline is described.

3178. HÜGI, T. AND MEIER, W.

Spectrographic Investigation of Swiss Copper Ores.

Experientia, 5, 283-5 (1949).

Spectrochim. Acta, 4, 184 (1950).

The samples are burned in an arc (40-50 v., 2-3 amp.) either directly or after separation into various fractions because of the relatively small dispersion of the spectrograph (Zeiss Q24). The analysis results are presented in tables, and their mineralogical and geochemical significance are discussed.

3179. HUGO, T. J. AND STRASHEIM, A.

The Spectrochemical Determination of High Percentages of Antimony in Antimonial Lead.

J. S. African Chem. Inst., 2, 7-14 (1949).

C. A., 44, 2886i (1950).

The analytical conditions for the spectrochem. detn. of Sb in Pb alloy are given as: power, $\frac{1}{2}$ kv.-amp. high-voltage spark; secondary inductance, 0.045 millihenry; primary voltage, 60 v.; exposure, 40 sec.; pre-spark, 10 sec.; photographic plate, Ilford thin film half tone; slit width, 0.02 mm.; upper electrode $\frac{1}{2}$ in. graphite, hemispherical cone; analysis line pairs, Sb 2426.4/Pb 2428.6 and Sb 2692.3/Pb 2697.5. The accuracy is better than 3% for the concn. range 2.4-16.3% Sb.

3180. HURST, J. E. AND RILEY, R. V.

A Metallurgical Examination of a Cast-iron Cannon Ball.

Foundry Trade J., 87, 261-6 (1949).

C. A., 43, 9005i (1949).

A specimen of a casting approx. 300 yrs. old was discovered near the Cathedral Close of Lichfield. The ball was 4.9 in diam. and weighed 14.25 lb. The d. of 6.13 indicates unsoundness which on sectioning showed an unexplained oxidized inner surface. The compn. was total C 3.20, graphite C 2.76, combined C 0.44, Si 0.80, S 0.056, P 1.12, Mn 0.48%, H 5 ml. per 100 g., O 0.0032%, N 0.0065%. The following elements were detd. by spectrographic analysis: Ni less than 0.05, Cr less than 0.05, V 0.10, Ti 0.12, Cu 0.08, Al 0.10, Sn 0.09%, The following elements were sought, but not found: Zr, Zn, Rh, Se, K, Mo, Ag, Pt, Hg, Be, W, Au, Cd, Na, Mg, Pb, Ge, Te, Ca, and rare earth elements. The microstructure was randomly distributed graphite in a matrix of pearlite and ferrite. The specimen indicates high skill of the iron founders of the 17th century.

The dimensional tolerance would be difficult to improve today. The shrinkage cavity was normal and centrally located. The quality of the Fe was equal to modern standards.

3181. HUSTLER, H. M. AND HAMMAKER, E. M.

Spectrographic Determination of Trace Elements in Silica.

Anal. Chem., 21, 919-21 (1949).

C. A., 44, 70d (1950).

A quant. spectrographic method for detg. Mo, Co, Fe, Mn, Cr, Pb, In, Bi, Ni, and Sn in silica with AgNO₃ as a combination buffer and internal standard is described. Working curves were established for 0.0002-0.02% and up to 0.1% for Fe. To test the applicability of the method, 11 glass sands were analyzed for their Fe content with an overall mean deviation of approx. 12%. The limits of detection of 45 other elements in silica were detd.

3182. IRISH, P. R.

Precision of Spectrographic Analyses of Steel.

Elec. Furnace Steel Conf., Am. Inst. Mining Met. Engrs., *Proc.* 7, 110-17 (1949).

The following factors affecting precision are discussed: computing method, density difference between lines of the line pair, wavelength separation of the lines, excitation potentials of the lines, and the way in which standard samples are employed.

3183. IVAGINA, P. N., IVAGIN, P. N., RUDNEVSKIĬ, N. K., AND STRONGIN, G. M.

Spectral Determination of Magnesium in Aluminum Alums.

Zavodskaya Lab., 15, 1140-2 (1949).

C. A., 45, 7466b (1951).

Pure C electrodes are immersed for 5 min. in a soln. of 125 g. alum./l. and dried. In a 6 amp. a.-c. arc with a 2-mm. gap between the electrodes, in 30 sec. exposure, $8 \times 10^{-7}\%$ Mg in the soln. can be detected by the line Mg I 2852.1 Å. For quant. analysis, the intensity of that line is compared with the line Al II 2816.18 Å.

3184. IVANOV, D. N.

The Application of the Electron Multiplier for the Determination of the Alkali Elements.

Pochovedenie (Pedology), 1949, 423-6.

C. A., 44, 5758g (1950).

The multiplier is described and illustrated. The principal spectral lines of the alkali metals were measured: Li 6708 Å, Na 5890/95 Å, K 7665/99 Å, Rb 7800 Å, Cs 8521 Å. An acetylene-air flame was used to excite the spectrum. The logs of the deviations of the mirror galvanometer (which express the logs of the intensity of the spectral lines)

are plotted against the logs of the concns. of the elements within the limits of $1 \times 10^{-4}\%$ to $1 \times 10^{-2}\%$ for Na and K, $5 \times 10^{-4}\%$ to $1.1 \times 10^{-2}\%$ for Li, Rb, and Cs. This method can be used in soil analyses. A comparison with standard techniques shows this method to be accurate.

3185. IVANOV, D. N.

Improvement of Sensitivity of Determination of Elements in Flame Test.

Zavodskaya Lab., 14, 1136-8 (1949).
C. A., 43, 4595i (1949).

Passage of a high-voltage a.-c. discharge through an acetylene-air flame along the height of the flame, with 18 to 20-cm. electrode spacing when the test solns. are introduced, showed that the intensity of spectral lines is significantly improved (25-28 kv.) without solns.; drops to 3-5 kv. when elements with low ionization potential are used. The intensification is not uniform through the spectrum; tests with Na, Ca, and Cu, with or without added K or Zn, showed that in pure solns. intensification may reach a factor of 10-15; the effect is smaller when mixts. are used. The effect is caused by increased flame temp. The method has no advantage over a high-voltage spark, except for lack of noise and better stability.

3186. JOOS, G. AND ANGERER, E. VON

Handbuch der Experimental-Physik. Vol. XXI.

Anregung der Spektren. Spektroskopische Apparate. Ann Arbor, Mich.: J. W. Edwards Co. (1949), 575 pp. \$14.

The first 202 pages of this 1927 Handbook discuss experimental spectroscopy in the light of the Bohr theory, quantitative excitation investigations, and some properties of spectral lines and practical light sources. The principles and properties of prism, of grating, and of interference spectroscopes are presented in 143 pages. A chapter of 47 pages deals with wavelength measurements, visual photographic and electrical methods of observing spectra, and photographic photometry.

3187. KACZOR, E. AND CHAMBERLAIN, K.

An Air Interrupter for Use with the Applied Research Laboratories Spark Source.

J. Optical Soc. Am., 39, 917-19 (1949).

Substitution of an air interrupter for the rotary gap on this spark source is not practical as the transformer lacks power to charge the capacitors to sparking potential several times per second. A separate unit is described which is powered by the transformer in the original unit. Changeover from conventional operation with the rotary gap to air interruption is rapid and convenient.

To study single patterns, a camera synchronizing attachment has been built that makes it possible to photograph a single trace on an ordinary oscilloscope with green, medium, persistence screen. An Eastman Twin Lens Reflex camera was used. The moving contact that is built into the shutter closes the circuit to charge a condenser after the leaves are fully open. This potential is applied to the vertical plates of the oscilloscope and produces a single horizontal sweep across the screen. The shutter time is made long enough to take advantage of the full persistence period of the trace. Fully exposed photographs of single sweeps can be obtained on Verichrome film.

3188. KAISER, H.

Systematic Arrangement for Spectrochemical Analysis.

Instruments and Measurements Conf., Stockholm., *Trans.*, 1949, 23-8 (in German).

C. A., 45, 7909d (1951).

The use of a system in performing spectrochem. analyses is discussed. The attack of any problem includes a knowledge of (1) the prepn. of the sample, (2) light emission (evapn. and excitation), (3) control of the light, (4) spectral analysis, (5) recording app., (6) selection and coordination of the spectral lines, (7) measurement of the intensity, (8) arithmetical calcs., (9) standardization of the method, and (10) evaluation of the worth of the analysis.

3189. KAISER, H.

Photographic-photometric Calibration of Step Filters.

Spectrochim. Acta, 3, 518-37 (1949).

C. A., 43, 8276e (1949).

Visual, photoelectric, and photographic methods for the calibration of step filters used in spectrochem. analysis are reviewed in detail. Examples are worked out, and details are given of photographic calibration procedures with an optical bench and movable source, or alternatively with neutral filters. Methods of calcg. filter factors at various wavelengths and for various steps with a min. no. of observations are also worked out.

3190. KAISER, H.

Remarks on the Method of Homologous Line Pairs.

Z. Naturforsch. 4a, 565-70 (1949).

The Gerlach-Schweitzer method of homologous line pairs, first proposed in 1925, is critically examined. The conditions imposed fall into two groups, the first are related to photometric evaluation and the second depend on the light source. It is concluded that the method still has practical possi-

bilities, but the discharge conditions in the light source can now be determined more accurately than was formerly possible with a "fixation pair" consisting of a spectral line belonging to neutral atoms and one belonging to ionized atoms.

3191. KAKIHANA, H.

Qualitative Spectrographic Analysis of Flue Dusts, Mainly Produced in Japan. I. The Flue Dusts Containing Germanium.

J. Chem. Soc. Japan (Pure Chem. Sect.), **70**, 226-9 (1949).

C. A., **45**, 2647f (1951).

Sixty-three samples of flue dusts produced in Japan and Korea were qualitatively analyzed spectrographically and Ge was detected in 9 of them. Dusts produced in the Saganoseki refinery, Oita Pref. and in the Shisakajima refinery, Ehime Pref. contained the highest quantities of Ge. Ge is generally found in the dusts in which Zn, Pb, As, Cu, Sn, and Sb are main components. Indium and Cd show a tendency to coexist with Ge, while Tl and Ga do not accompany Ge.

3192. KAKIHANA, H.

Qualitative Spectrographic Analysis of Flue Dusts, Mainly Produced in Japan. II. The Flue Dusts Containing Gallium.

J. Chem. Soc. Japan (Pure Chem. Sect.), **70**, 300-3 (1949).

C. A., **45**, 2647h (1951).

The samples used for the analysis of Ge were analyzed for Ga spectrographically. Ga was found in 12 of them. Dusts produced in the Niigata factory of the Nitto Ryuso Co. showed highest concn. Ga is found generally in the flue dusts which contain Fe, Si, Mg, and Al as main components. Ba, V, and Ni may coexist with Ga, while Zn, Pb, Sn, Sb, As, In, Mo, Cd, and Tl may accompany Ge but not Ga.

3193. KARLIŃSKI, Z. AND CZAKOW, J.

Spectrographic Determination of Silicon in Hardened Cast Iron.

Prace Badawcze Głównego Inst. Met. i Odlew., **1949**, 139-45 (French summary). *C. A.*, **44**, 4824e (1950).

A rapid spectrographic method for the detn. of Si in cast iron is described.

3194. KATCHENKOV, S. M.

Correlation of Petroleum by the Microelements.

Doklady Akad. Nauk S.S.S.R., **67**, 503-5 (1949).

C. A., **43**, 8654g (1949).

Spectral examn. of petroleum ash reveals over 30 elements. C, Cu, Sr, Ni, and Mg are

close to av. values in over 80% of samples tested. Paleozoic samples have more V than Ni, Mesozoic shows reverse values, as do the Tertiary formation. Ni/Cu is higher in Paleozoic than in Tertiary specimens. Fe/Ni shows the reverse of V/Ni in terms of age of the sample. Mg/Sr does not give good age correlation.

3195. KAUFMAN, D. AND DERDERIAN, S. K.

Tungsten in Low-grade Ores. Spectrographic Determination.

Anal. Chem., **21**, 613-16 (1949).

C. A., **43**, 8957h (1949).

Siliceous ores and ore products are analyzed by dilg. samples with SiO_2 to below 0.05% WO_3 and burning in the d.-c. arc. with 1:1 or 1:2 parts AgCl. The d. of line 4294.6 Å is compared with specially prepd. W standards. Conditions are controlled so that Fe up to 50% Fe_2O_3 does not seriously interfere. Under best conditions concns. of WO_3 from 0.001 to 0.3% can be detd. with a probable error of about 5%.

3196. KELLER, W. D.

Higher Alumina Content of Oak Leaves and Twigs Growing Over Clay Pits.

Econ. Geol., **44**, 451-4 (1949).

C. A., **45**, 3911i (1951).

Qual. spectrographic analysis, and quant. estimates, of ash from oak leaves and twigs, indicate a higher alumina content in trees growing over clay as compared with those growing on ordinary soil.

3197. KENNEDY, W. R.

Spectrographic Analysis at the American Cast Iron Pipe Co.

Elec. Furnace Steel Conf., Am. Inst. Mining Met. Engrs., *Proc.* **7**, 125-6 (1949).

The spectrograph is employed for the determination of Si, Mn, Cr, Mo, Ni, Cu, V, Ti, Sn, Al, and Zr in steel, including stainless. In cast iron the same elements are determined and Sb, Pb, As, and Mg are included. Slag is also analyzed. Costs of analyses are discussed but analytical details are not given.

3198. KENT, L. E. AND RUSSELL, H. D.

Warm Spring on Buffelshoek, near Thabazimbi, Transvaal.

Trans. Roy. Soc. S. Africa, **32**, 161-75 (1949).

C. A., **43**, 8581d (1949).

Spectrographic examn. of the residue from evapn. to dryness showed that the major constituents were Na, Ca, Mg, and Si; the minor constituents were Li, Ba, Sr, Al, and B; and Pb, Mn, Mo, and Fe were found in traces.

3199. KLINGER, P. AND SCHLISSMANN, O.
Progress in Spectrochemical Analysis.
Arch. Eisenhüttenw., 20, 219-28 (1949).
C. A., 43, 7857g (1949).

To make a spectrum examn. of metallic and other surfaces with the smallest possible area, a special method was developed in which the spark passes from an Ag or Cu electrode of 1-mm. diam. at a distance of 0.5 mm. through a diaphragm of mica or gypsum with a hole of as little as $10\ \mu$ from the surface to be examd. Several examples illustrate the equipment and procedure. 14 references.

3200. KOPPIUS, O. G.
Detection of Lead in Air with the Aid of a Geiger-Müller Counter.
J. Optical Soc. Am., 39, 294-7 (1949).
C. A., 43, 4523c (1949).

The object of this investigation was the instantaneous detection of lead in air, or any other gas in concns. of the order of a few parts per 10 million by weight of air under standard conditions (20 micrograms per cu. ft. of air) without the aid of a photographic plate. The spectrum of Pb can be excited by passing the gas contaminated with Pb through a condensed spark discharge between pure Cu electrodes. Because photographic methods of detection were too slow and time consuming, it was advantageous to construct an instrument that would almost instantly locate areas of high Pb contamination. When the problem was first undertaken in 1944, photo-multiplier tubes, sensitive to the 2203.5 Å Pb line, were not available. For this reason a quartz Geiger-Müller counter was chosen as the detector. The present limitations on the accuracy of the results, and the lower limit of detectability, are fixed by the erratic behavior of the light source.

3201. KORITSKIĬ, V. G.
Advances of Emission Spectrum Analysis in U.S.S.R. in 1948.
Zavodskaya Lab., 15, 681-8 (1949).
C. A., 44, 69c (1950).
Review with 36 references.

3202. KORZH, P. D.
A Visual Method of Spectrographic Analysis with the Relative Intensity of a Line of a Given Element in Two samples.
Zavodskaya Lab., 15, 301-4 (1949).
C. A., 44, 10571i (1950).

The sample and a similar alloy of known compn. are excited in spark gaps which are alternately connected to a high-voltage spark source by a high-speed commutator. Light from the two samples is fed into respective halves of a split-field objective immediately in front of the slit. The relative concns. of the element in the two samples are judged by noting their relative distances from the slit

when the upper and lower halves of the spectral line are of equal intensity, and then applying the inverse square law.

- 3202a. KORZH, P. D. AND KOSLOVA, A. V.
Spectral Analysis of Some Ferroalloys for Silicon and Chromium.
Zavodskaya Lab., 15, 937-9 (1949).
C. A., 47, 3178g (1953).

The visual method of spectral analysis was used to det. Si in blast furnace ferrosilicon, ferromanganese, and silicomanganese and Cr in ferrochrome. The detn. was made by relative intensity of one and the same spectral line of the element in the spectrum of sample and of standard.

3203. KUBA, J.
Spectrographic Determination of Aluminum and Titanium in Steels.
Hutník 16, 121-7 (1949).
Hutník Listy, 4, 237-41 (1949) (in Czech.).
C. A., 44, 1358h (1950).

The detn. of Al (0.5-3.0%) is based on the photometric measurement of the spectral lines Al 3082.2 Å and Fe 3083.7 Å and for smaller quantities the lines Al 3961.5 Å and Fe 3963.1 Å. The detn. of Ti is based on the photometric measurement of the spectral lines Ti 3387.8 Å and Fe 3465.86 Å. Details of the methods are given.

- 3203a. KUDEL'YA, E. S.
Synthetic Standards for Spectral Analysis.
Zavodskaya Lab., 15, 691-5 (1949).
C. A., 47, 3171b (1953).

Powd. Fe (reduced with H) made a satisfactory Fe base for specimens that, after mixing thoroughly in a rotating flask, were pressed at 8 tons per sq. cm., then heated in H at 1000° for 2 hr., cooled in H, repressed at 10 tons per sq. cm., and reheated at 1000° for 2 hr. in H. Similar standards were prepd. with electrolytically refined Mn powder and powd. Fe, contg. 0.27, 0.31, and 1.08% Mn. Heat treatment as above failed to cause any detectable loss of Mn from the pellets, and the distribution of Mn in the specimens was excellent. Any Fe oxides in the initial material are reduced during the heat treatment changing the wt. of the specimen. Specimens prepd. from powd. Fe and powd. Al in a similar manner also showed no loss of Al during treatment, and good specimens contg. 0.0158-1.565% Al were readily obtained.

3204. LANGE, N. A., Ed.
Lange's Handbook of Chemistry. 7th Ed.
Handbook Publishers, Inc., Sandusky, Ohio (1949), 1920 pp.
Reviewed in *J. Am. Pharm. Assoc.*, 38, 667 (1949).

Wavelength tables of emission spectra are given from pages 1076 to 1099.

3205. LOEUILLE, E.

The Exponent of the Number of Atoms in the Expression for the Intensity of Emission of a Spectral Line.

Spectrochim. Acta, 3, 475-87 (1949).

C. A., 43, 8272d (1949).

Each spectrum line intensity is proportional to the m th power of the at. concn. of the element emitting it in the source. If the density or intensity difference of 2 spectrum lines used in analysis be plotted against the concn. of the impurity, a calibration line is obtained. Such calibration lines are shifted laterally when the base-metal concn. is varied in the alloys. It is shown that m can be calcd. from the shift of calibration lines with an accuracy limited by the stability of the source and uniformity of the photographic process. E. g., for Fe 2926.6 Å, $m = 1.40$ and for Mn 2929.3 Å, $m = 0.85$.

3206. LÖWE, F.

Optische Messungen des Chemikers und des Mediziners. 5th ed.

Dresden: T. Steinkopff (1949).

C. A., 44, 5205a (1950).

Reviewed in *Farben, Lacke, Anstrichstoffe*, 4, 102 (1950). Fifth revision of a German handbook on applied spectroscopy, photometry, and refractometry, first published in 1925. Applied spectroscopy deals with types of spectrosopes and spectrographs, and with absorption, emission, and Raman spectra applied to chemical identification and quantitative determination.

3207. LUNDEGÅRDH, P. H.

The Geochemistry of Chromium, Cobalt, Nickel, and Zinc.

Sveriges Geol. Undersökning, Ser. C., Avhandl. och Uppsat., No. 513; Årsbok 43, No. 11, 56 pp. (1949) (in English).

C. A. 45, 88b (1951).

This is a summary of L.'s detns. of Cr, Co, Ni, and Zn in Swedish minerals, rocks, and soils based partly on new data, partly on those published previously. The data are treated statistically and the results are used in the interpretation of the petrology and manner of formation of igneous and igneous-looking rocks. The following abundance values for 4 elements in the earth's crust are considered to be the best: Cr less than 200 g./ton, Co 40, Ni 100 (max.) Zn 100. L. finds the order of abundance $Cr > Ni > Co$ as characterizing the first differentiates formed by fractional crystn. of basic magmas, whereas in late-magmatic rocks the order is $Co > Ni > Cr$ and in Swedish argillaceous sediments and in their metamorphic derivs. $Cr < Co < Ni < Zn$. The results of spectrochem. detn. of Cr, Co, Ni,

and Zn in 253 samples of Swedish rocks and soils (169 composite samples) are given. Swedish rocks are usually low in Cr. The biogeochemistry of the 4 metals is discussed. During palingenesis they are rather immobile. 64 references.

3208. MAASSEN, G.

Spectroscopic Determination of Lead, Antimony, Iron, and Zinc in Bronze and Red Brass.

Z. Erzbergbau u. Metallhüttenw., 2, 103-12 (1949).

C. A., 43, 6539a (1949).

A review with 17 references.

3209. MALAMAND, F.

Spectrographic Determination of Carbon in Ordinary Steels and Refractory Alloys (Vitalium).

Congr. groupement avance method. anal. spectrograph. produits mét., 12, 59-67, 179-87 (1949).

C. A., 45, 3759a (1951).

C III at 2296.86 Å was used for C analysis to give a precision of $\pm 5\%$ in C content of 0.16-1.00% for steels and 0.12 to 0.96% in the Vitalium alloys. Ni II at 2297.138 and 2296.55 Å were sepd. from the C line with a medium dispersion spectrograph and a slit of 10 to 15 μ but the extent of their interference in the analysis was not evaluated.

3210. MARKS, G. W. AND POTTER, E. V.

The Spectrochemical Determination of Thallium in Ores, Concentrates, Dusts, and Chemicals.

U. S. Bur. Mines, *Rept. Invest. No. 4461*, 13 pp. (1949).

C. A., 43, 5334g (1949).

With the total-energy method, studies concerning the effect of sectored disks upon the intensity of $Tl \lambda 5350.46$ Å, as recorded photographically, showed that the intensity is reduced more than would be indicated theoretically by the reduction in size of the total aperture angle, the discrepancy increasing as the angle is reduced. The effect is especially serious when materials of high volatility are studied. This error was eliminated by the use of glass filters to reduce the line intensities. In most cases line d. could be equalized largely by the addn. of excess $BaCO_3$. A spectrographic standard for Tl was prepd., from a mixt. of TlI, $BaCO_3$, and graphite and a Corning-glass filter No. 5330 to reduce line intensities. This standard was then employed for detg. Tl in a series of dust samples to which considerable $BaCO_3$ +graphite mixt. was added before volatilization in the arc. The results agreed well with chem. analyses.

3211. MATHIEN, V.

Determination of Residual Elements in Steel by Means of an Intermittent D-C Arc.

Comptes rend. Inst. Rech. Sci. Ind. Agr., 1, 71-5 (1949).

Spectrochim. Acta, 4, 185 (1950).

A 10-amp. arc (130 v., arc gap 3 mm.), initiated by a high-frequency discharge, is obtained between a flat surface of the steel sample and a counterelectrode of pure graphite. The electrodes are water cooled. Steel samples for analysis are cast in a special mold designed to give a homogeneous structure. Line pairs and ranges of concn. are listed for the elements Mn, Si, Cr, Mo, Sn, Ni, and Cu. A medium-size spectrograph (Hilger E3) was used and although the dispersion of such an instrument would generally be regarded as too low for the satisfactory analysis of steels, its performance was found to be adequate. Analytical errors were $\pm 5\%$ of the content.

3212. MAYER, W.

Detection of Self-inflicted Injuries by Chemical Means.

Süddeut. Apoth.-Ztg., 89, 98-101 (1949).

C. A., 43, 4183d (1949).

A scheme for the examn. of skin lesions is given. The lesion is first examd. under the microscope and its pH detd. by pressing moistened indicator paper against it. A sample of the material (2-5 g.) is then dialyzed, the color of the dialyzate and any fluorescence under ultraviolet light noted, and the soln. subjected to qual. analysis for acids, phenols, etc. The residue and any unused portion of the dialyzate are then refluxed with 30% H_2SO_4 and the mixt. steam-distd. The distillate is examd. qualitatively. A fresh sample is ashed and the ash examd. for metals, preferably spectrographically. Qual. tests for agents likely to be used in self-inflicting skin lesions are reviewed.

3213. MAZUNDER, K. C. AND GHOSH, M. K.

The Spectrochemical Determination of Carbon in Ferrous Alloys.

Indian J. Phys., 23, 477-82 (1949).

C. A., 44, 6341i (1950).

With a Hilger large quartz spectrograph under these conditions: voltage, 15,000; capacity, 0.005 microfarad; inductance, nil; spark gap, 2.0 mm.; upper electrode, pointed copper rod; lower electrode, conical samples with flat-top 2-mm. diam.; measurements of 2297 Å. C line permitted detns. within $\pm 0.02\%$. When more than 0.40% C is present, dry N was blown over the spark gap.

3214. MAZUMDAR, K. C. AND GHOSH, M. K.

Spectrochemical Analysis of Trace Elements in Cinchona Leaves.

Science and Culture, 15, 162-3 (1949).

C. A., 44, 2701h (1950).

Spectral line intensities of the leaf ash were compared with those of standards contg. the trace elements Zn, Ba, Sr, Cr, and Cu in known and comparable amts. Results of the analyses are given for plants 2 and 7 years old.

3215. McCLELLAND, J. A. C.

Applications of the Intermittent Alternating Current Arc. II. Determination of Rare Earths.

Analyst, 74, 529-36 (1949).

C. A., 44, 971h (1950).

To the soln. of the sample obtained by treatments with HF and other mineral acids add NH_4OH and ignite the filtered and washed ppt. To it add 0.25 g. of Fe_2O_3 of suitable particle size. The quantity of Fe_2O_3 should be at least 10 times that of the rare earth oxides. Triturate the mixt. of oxides with 1 g. of KHSO_4 and transfer the powder to a cupped graphite electrode which has a crater 1-1.5 mm. deep and leveled off. Heat the electrode on a hot plate until fusion starts and spread the mass evenly over the surface with a steel blade, to give a smooth coating to the electrode. Precise directions are given for using the electrode in a large Littrow spectrograph. The suitable spectral lines are listed for detg. 17 rare earth and assocd. elements by comparison with spectral lines of Fe. With samples contg. 0.1-0.7% of element, the results are usually within 10% of the truth.

3216. McNALLY, J. R., JR.

A Preliminary Investigation of the Spectra of Uranium Isotopes.

J. Optical Soc. Am., 39, 271-4 (1949).

C. A., 43, 4567a (1949).

The isotope displacement effect is discussed with relation to other spectro-isotopic effects. The results of a preliminary investigation of this effect in U isotopes are presented. Spectrum shifts as large as a wave number between the U^{235} and U^{238} spectra are not uncommon, the shifts usually being towards the violet for the light isotope. These wavelength differences have been correlated to the spectroscopic energy systems of U I and U II and are of two types: (1) a simple isotopic displacement arising from configuration-nucleus interaction, and (2) a complex isotopic displacement arising from perturbations between close-lying levels. The magnitude of shift in U I is generally of the order of 0.3 cm^{-1} , but ranges from -0.7 cm^{-1} to 1.5 cm^{-1} in U II. Configurations involving the s^2 electron group show the largest isotope shifts; this indicates an additive type of interaction for the s electrons and the nucleus.

3217. MEGGERS, W. F.
Emission Spectroscopy.
Anal. Chem., 21, 29-31 (1949).
C. A., 43, 2113e (1949).
A review of the principal postwar advances in fundamental and applied emission spectroscopy, with 64 references.
3218. MEHROTRA, R. C.
A Qualitative Study of Flame Test for Tin, Gold, and Bismuth.
Proc. Natl. Acad. Sci. India, 18A, 103-9 (1949).
C. A., 45, 8938b (1951).
Investigation of the blue flame test for Sn disclosed that Cl^- , Br^- , and I^- ions gave blue, green, and yellow mantle colors, resp., SO_4^{--} , NO_3^- , and F^- ions interfere. Halides of Bi and Au yield similar colors. A sensitive flame test for Au is as follows: To the Au salt soln. in a beaker, add concd. HCl and trace of Zn. Hold a test tube of cold water at the point where H is briskly evolving, and then place it in the hottest part of the Bunsen flame. If Au is present a very brilliant green flame surrounds the bottom of the tube and spreads upwards along the sides of the tube. The test is sensitive to 0.1 mg. of Au per ml. of concd. HCl. Sn and Cu interfere but Hg, Pb, Ag, and Pt do not. Ores and alloys can be tested for Au by dissolving the residue insol. in HNO_3 in aqua regia, evapg. nearly to dryness, and applying the flame test. The blue flame given by Sn cannot be due to stannic hydride as has been supposed. A tentative mechanism is suggested for the reactions of Sn, Bi, and Au.
3219. MENE, P. S. AND DESHMUKH, D. J.
Effect of Alkali Chlorides on the Intensity of the Cyanogen Bands in Carbon Arc.
Current Sci. (India), 18, 373 (1949).
C. A., 44, 10503f (1950).
The intensity of CN bands can be reduced if the C electrodes are coated with alkali chlorides by dipping vertically in satd. solns, and evapg. to dryness. Results indicate suppression is most effective in the case of Cs and least for Li.
3220. MERCADER, A. L. AND BENAVENTE, E. P.
Spectroscopic Determination of Uranium in Minerals.
Anales asoc. quim. argentina, 37, 235-45 (1949).
C. A., 44, 3839i (1950).
U was detd. by the cathode layer method in concns. less than 1%, with results in agreement with chem. analysis. Mo was used as standard and the background was corrected according to Scott (*C. A.*, 38, 1971⁶). The method can be extended to concns. of less than 0.5%.
3221. MICHEL, P.
Calibration of Standard Samples of Light Alloys.
Congr. groupement avance. méthodes anal. spectrograph. produits mét. (Paris), 11, 81-7 (1949).
C. A., 44, 6766e (1950).
Sample melts of Al alloys are chill cast on a cast iron plate to minimize segregation. The sample plates are then examd. micrographically for evidence of segregation. The inner core of the slab is cut into spectrographic electrodes and the metal surrounding the electrodes is used for chem. analysis. Homogeneity was tested by spectrochem. analysis of different electrodes, and the scatter of results was comparable to that from repeated runs of the same electrode. The mean of the chem. analyses of each sample was further corrected by plotting the results of spectrochem. analyses on all samples, and fitting the points to a straight line on the analytical curve. Analyses are given for the following elements over the ranges indicated: Cu, 0.19-2.15%; Mg, 0.09-5.63%; Fe, 0.35-1.66%; Si, 0.55-13.89%; Mn, 0.26-1.61%; Ni, 0.19-1.50%; and Ti, 0.06-0.33%.
3222. MICHELMAN, J.
Analysis of a Varnish Used by Stradivarius.
J. Franklin Inst., 247, 569-71 (1949).
C. A., 44, 348b (1950).
A 10-fold range spectrographic analysis of varnish from the Prince Gunski Stradivarius cello made in 1697 indicated that Al and Si were each present 0.08 to 0.8%; Ca 0.03% to 0.3%; Fe, Mg, Na each 0.01% to 0.1%; Pb 0.008 to 0.08%; Cu, Ag, Sn, B each 0.005 to 0.05%; while Cr, Ni, K, and Ti were not detected. These finds are in agreement with previous analyses of old Italian brown varnishes. The brown color in these varnishes is attributed to the presence of a small amt. of Fe rosinated. The development of color increases with time.
3223. MIKA, J., MACHER, F., AND VORSATZ, B.
The Low-tension Spark as Light Source in Quantitative Spectral Analysis.
Anal. Chim. Acta, 3, 228-51 (1949) (in German).
C. A., 43, 8297e (1949).
A systematic study has been made, with the aid of mobile and rotating mirrors and spectrography, of the various factors which may influence the nature of the discharge of low-tension sparks: change of high-frequency current, self-induction, capacity of the discharge circuits, intensity and tension of the current, as well as the distance between the electrodes. It is possible to use a.c. as well as d.c., even without a mech. interrupter, if in

the case of high-frequency current a suitable app. is employed.

3224. MIKHALYEVSKII, V. D.

Spectrochemical Analysis of Aluminum Alloys with a Low-voltage Intermittent Alternating-current Arc with Interrupter. *Zavodskaya Lab.*, 15, 117-19 (1949).

C. A., 44, 73g (1950).

To minimize melting, M. interrupts the discharge every ~ 0.25 sec. for ~ 0.06 sec. by means of a commutator. The accuracy of analysis for Mn, Mg, Fe, Cu, and Si in Al is not affected by this procedure.

3225. MILLMAN, P. M.

One Hundred Meteor Spectra.

Astron. J., 54, 177-8 (1949).

C. A., 44, 32i (1950).

To date spectra have been photographed, by various observers, of just over 100 meteors. The following atoms have been identified as fairly certain: neutral Fe, Na, Ca, Mg, Mn, Cr, Si, Ni, Al, and singly ionized Ca, Mg, Si. In two spectra there was good evidence for FeO. Although the meteors investigated belong to different showers the spectra from each major shower are remarkably similar to each other.

3226. MONNOT, M.

Spectrographic Studies on Steels and Alloys.

Congr. groupement avance. method. anal. spectrograph. produits mët., 12, 85-92 (1949).

C. A., 45, 3760c (1951).

The adopted methods for Ni, Cr, and Mo steel are reviewed. The Fe content served as a basis for the comparison of spectral lines observed in these alloy steels. The determinations of Al, Cr, Cu, Mn, Ni, Si, V, and W are discussed.

3227. MOORE, C. E.

Atomic Energy Levels as Derived from the Analyses of Optical Spectra.

U. S. Natl. Bur. Standards Circ. 467, Atomic Energy Levels 1, 309 pp. (1949).

C. A., 43, 8883f (1949).

This vol. is the first of a series being prep'd. as part of a general program on atomic energy levels derived from observations of optical spectra. It gives all known facts regarding spectral terms or at. energy levels of 206 spectra belonging to the first 23 atomic numbers, H to V. It was originally planned to issue this information in three sections but after Section 1 was released (*C. A.*, 42, 6654e) it was decided to publish only complete volumes. This book contains an introduction to the series, explaining the scope and style of presentation, including complete tables of theoretical spectral terms, magnetic splitting factors, and first ionization potentials.

3228. MOSHER, R. E., BOYLE, A. J., BIRD, E. J., JACOBSON, S. D., BATCHELOR, T. M., ISERI, L. T., AND MYERS, G. B.

The Use of Flame Photometry for the Determination of Sodium and Potassium in Plasma and Urine.

Am. J. Clin. Path., 19, 461-70 (1949).

C. A., 43, 5441g (1949).

There is an approx. linear relationship between concn. and transmittance of Na and K in the flame photometer; hence, it is only necessary to det. the transmittance of 1 standard above and 1 below the unknown concn. Recovery studies show less than 4% error. Viscosity influences the rate of atomization and thus the transmittance value. Increasing amts. of gelatin in the soln. depressed the transmittance. In pathol. urine gelatin should be added to standards to equal the protein present. K in urine had no influence on the detn. of Na, but the Na increases the K readings. Glucose in concns. over 2% caused significant depression in transmittance values of both Na and K.

3229. MUKHERJEE, B. AND DUTTA, R.

Germanium in Indian Coal-ash.

Science and Culture, 14, 538-9 (1949).

Spectrochim. Acta, 4, 181 (1950).

Two spectrographic methods are described for the detn. of germanium in coal ashes, the cathode layer carbon arc, and the logarithmic wedge sector method with anode excitation. Both methods are sensitive down to 0.001% Ge, the Ge lines 3039.09 and 2651.18 Å being used.

3230. MÜLLER-URI, G.

Spectral-analytical Investigations of Sand-cast and Chill-cast Alloys of Aluminum, Silicon, and Copper.

Spectrochim. Acta, 3, 560-8 (1949).

C. A., 43, 8307c (1949).

A method for the spectrochemical analysis of type G Al alloys now much used in Germany is described. This alloy contains 5% Si and lesser amts. of Cu, Mg, Fe, and Mn. Chill cast rods 3 mm. diam. are sparked with a Feussner-type source and photometric measurements are made relative to Al 3050 and Mg 2780, Si 2882, Cu 3274, Mn 2949, and Fe 2756 Å. A single analysis requires 20-25 min.

3231. MURRAY, M. J. AND PLAGGE, H. A.

Spectrographic Analysis of Gas Oils and Crude Oils for Metallic Constituents.

Proc. Am. Petroleum Inst. III, 29M, 84-8 (1949).

C. A., 44, 4659h (1950).

The oil is ashed with either highly purified, finely divided SiO_2 , or pure, powd. Al_2O_3 . A sector spectrogram of a weighed quantity

of the SiO_2 + ash mixt. is taken with the d.-c. arc and compared with spectrograms of synthetic standards. The detd. value for the metallic constituent is between 0.5 and 2 times the true value. This is deemed sufficient accuracy considering the accuracy limitations of sampling and ashing.

3232. NABSER, G. AND PEPPERHOFF, W.
Flame Radiation of the Basic Converter.
Stahl u. Eisen, 69, 391-8 (1949).
C. A., 45, 9437g (1951).

Flame radiation in the basic converter was investigated to serve as a process control in air-blast refining. The energy distributed in the flame spectrum was measured as a function of the blast period.

3233. NAGATA, M.
Spectrographic Analysis of Minute Quantities of Metals in Plant Materials. I.
J. Chem. Soc. Japan (Pure Chem. Sect.), 70, 410-11 (1949).
C. A., 45, 3043f (1951).

Ashes of leaves, flowers, branches and roots of tobacco, potato, persimmon, camelia, and cherry, etc., were analyzed qualitatively by spectrographic methods. About 30 elements were detected.

3234. NAHSTOLL, G. A.
Routine Spectrochemical Analysis in the Ford Motor Co.
Elec. Furnace Steel Conf., Am. Inst. Mining Met. Engrs., *Proc.*, 7, 117-18 (1949).

A general discussion of operations in the foundry laboratory, the open-hearth laboratory, and the mobile laboratory, including work loads, costs, and brief notes on techniques. Irregular specimens have a small piece removed which is then welded to a rod to form a pin electrode. Scrap is analyzed by the mobile laboratory.

3235. NICOL, J.
Multiplier Photocells—Characteristics with Particular Reference to Their Application in Spectrographic Analysis.
Met. Treatment, 15, 217-23 (1948-49).
Spectrochim. Acta, 4, 258 (1950).

The author critically reviews the present position, mainly with reference to American publications on the subject, in the light of experience of R.C.A. electron multiplier photocells gained in the British Non-Ferrous Metals Research Association's laboratories. The important cell characteristics, and their bearing on analytical work, are discussed and a comparison of the direct-reading technique with photographic methods is made.

3236. NIKITINA, O. I.
Spectrographic Analysis of Basic Open-hearth Slags.

Zavodskaya Lab., 15, 855-7 (1949).
C. A., 44, 483a (1950).

The suitable line pairs are: for Ca 3179 Å (Ca) and 3145.72 Å (Ni); as well as 3158.87 (Ca) and 3145.72 (Ni); for Si 2881.58 (Si) and 2821.29 (Ni); for Mn 2933.06 (Mn) and 2821.29 (Ni); Fe 3047.6 (Fe) and 3045.72 (Ni); for basicity index (CaO/SiO_2), 3158.87 (Ca) and 2881.58 (Si).

3237. NORRIS, D. K. AND HOGG, F. S.
A Search for Meteoric Matter in Atmospheric Dust.
Astron. J., 54, 192-3 (1949).
C. A., 44, 33b (1950).

Samples of atm. dust collected in southern Canada, and also in northern Canada under winter conditions, show metallic fragments that are undoubtedly of meteoric origin. Spectrochem. analysis of the southern samples gave pos. evidence for the presence of Ni, Fe, Mg, and Si.

3238. NUCIARI, T.
Application of Spectrographic Analysis to Aluminum-zinc-magnesium Alloys.
Aluminio, 18, 476-80 (1949).
C. A., 44, 4371f (1950).

The spectrographic detn. of Zn, Mg, Cu, Fe, Mn, Cr, and Ti in alloys contg. chiefly Zn, Al, and Mg.

3239. OLEŇNIKOV, A. P. AND TAGANOW, K. I.
Spectrographic Method for the Determination of Carbon in Steels.
Zavodskaya Lab., 15, 59-62 (1949).
C. A., 44, 72i (1950).

A low-power high-frequency exciting circuit avoids the high background created near $\text{C III } 2297 \text{ Å}$ by the standard Sventitskii intermittent low-voltage arc. From 0.1 to 2% C can be detd. in steels with 2-5 min. exposures with Fe II 2294.6 Å as an internal standard. Probable error for a single detn. is $\pm 3.5\%$.

3240. ONGARO, M.
Quantitative Spectrographic Analysis of Common and Special Steels.
Ingegneri (Milan), 23, 1069-83, 1205-12 (1949).
C. A., 44, 6765d (1950).

A comprehensive review of the principles, procedures, and app. used to det. the alloying elements in steel.

3241. ORSAG, J.
Instantaneous Spectrography.
Rev. mét., 46, 803-6 (1949).
C. A., 44, 2416a (1950).

Two photoelec. cells are used in place of a camera of a conventional spectroscop, one

of which records a reference line and the other a line of the element to be detd. Photocells are connected to vacuum tubes and then to a potentiometer, the scheme of connection being given. An element can be detd. by the method in 20 sec. and a concn. of 0.002% can be easily detd.

3242. PALMER, E. W., IRWIN, J. P., AND FOGG, C. C.

A Laboratory-cast Pin Sample for the Spectrographic Analysis of Copper-Base Alloys.

ASTM Bull. No. 160, 41-5 (1949).

C. A., 43, 8951i (1949).

Fine chip samples (approx. 1 g.) are remelted under A in a specially designed graphite crucible. These pins are then machined to dimensions which vary with the excitation conditions, and the elements to be detd. Replicate analyses are made on the same pin by remachining. A lab.-cast standard pin eliminates variations due to electrode size and shape.

3243. PASVEER, W.

A New Atlas of the Spark Spectrum of Iron.

Congr. groupement avance. méthod. anal. spectrograph, produits mét., 12, 123-4 (1949).

C. A., 45, 3711i (1951).

The spark spectrum of Fe was suitably enlarged and projected on Eastman Kodak Pathelite film. Contact prints were made and the wave-length scales were marked by a simple engraver, which adjusted to the particular enlargement.

3244. PASVEER, W.

A Method of Preparation of Electrodes for the Spectrochemistry of Precious Metals.

Congr. groupement avance. méthod. anal. spectrograph, produits mét., 12, 125-7 (1949).

C. A., 45, 3751c (1951).

Standards were prepd. by thoroughly mixing the powd. form and shaping pellets. These were then annealed and mounted in the electrode holders. A sample was rolled into a thin layer and from this a disk was cut and fitted over a mandrel similar in shape to the standard electrode. Loss of sample was thus negligible.

3245. PIERUCCINI, R. AND ZOTTI, R.

Biological Function of Strontium and Manganese in Teeth.

Atti soc. toscana sci. nat. (Pisa), Mem. Sér. A, 56, 119-26 (1949).

C. A., 45, 2087g (1952).

Spectrochem. analysis of teeth ash showed Sr, Na, Cu, Fe, Al, Si, B, Mn, Pb, and Li as minor constituents. Ni and Co were absent. Fe, Al, Si and Cu are geochemically very diffuse and Na and B are always present in organisms. Sr was higher in sound than in carious and higher in children's (even carious) than in adults' teeth. Sr decreased with the age. Mn was higher in carious than in sound and higher (slightly) in adults' than in children's teeth. Carious children's teeth contained more Mn than adults'.

- 3245a. PISAREV, V. D.

Photographic Attachment for the Steelscope.

Zavodskaya Lab., 15, 624 (1949).

C. A., 46, 828h (1952).

Steelscope spectra can be photographed by removing the shutter and lens from a camera and attaching it to a steelscope ocular by means of an extension tube.

3246. POKORNY, A.

Spectral Analysis of Metals.

Hutnicke Listy, 4, 352-6, 391-5 (1949).

C. A., 44, 4366b (1950).

A review.

3247. PRATT, P. F. AND LARSON, W. E.

Interference Filters in the Reduction of Error Due to Calcium in the Flame Photometric Determination of Sodium.

Anal. Chem., 21, 1296 (1949).

C. A., 44, 377c (1950).

An interference filter with max. transmission between 5790 and 5990 Å is used with an auxiliary glass filter to remove unwanted blue transmission bands.

3248. PREUSS, E.

Visual Spectrochemical Analysis with a Comparison Spectrum in a Specially Designed Plateholder.

Optik, 5, 406-13 (1949).

C. A., 44, 3834h (1950).

A comparison spectrum, held in a special plate holder, is illuminated from behind by an incandescent lamp. Light from the comparison spectrum passes through the spectrograph optics, and the comparison spectrum is brought to a focus in the plane of the spectrum to be analyzed. The image of the comparison spectrum can be made to coincide with the spectrum under study, and the colors of the 2 spectra will match. Application of the technique of visual analysis is described for: (1) identification of major constituents in an unknown sample, (2) detn. of Cu, Si, and Mg in Al, (3) detn. of Ti in org. materials, (4) detn. of Mn and Cu in steel, and (5) application to quant. analysis.

3249. PROKOP'EVA, A. N. AND TAGANOV, K. I.

Spectrum Analysis of Thick Nickel Wires and Foils.

Zavodskaya Lab., 15, 299-301 (1949).

C. A., 43, 6108e (1949).

The samples are suitably analyzed only in high-frequency spark (neither condensed spark nor a-c. arc were satisfactory), with a 1-mm. gap. The satisfactory spectral lines used were: Si 2516.1 Å and Ni 2509, Cu 3274 and Ni 3271.1, Mn 2576.1 and Ni 2584.

3250. RADICE, M. M.

Results of Spectrographic Analysis of Rhodochrosite and Accompanying White (Manganese) Carbonate from Capillitas (Catamarca).

Univ. nac. La Plata, Notas museo La Plata, 14, Geol. No. 56, 231-7 (1949).

C. A., 45, 9425h (1951).

Red and pink rhodochrosite showed essentially the same minor amts. of Fe, Ca, Mg, Si, Co, and Zn; the white carbonate contained no Fe or Si but had minor amts. of Zn, Ge, P, Al, Ag, Pb, and Bi.

3251. RATSBAUM, E. A.

Prevention of Loss in Spectroscopic Analysis.

Zavodskaya Lab., 15, 368 (1949).

C. A., 43, 6104g (1949).

The sample is mixed with dextrin glue.

3252. RICCIBONI, L., FOFFANI, A., AND PERLOTTO, T.

Spectrographic Determination of Gallium in Aluminum. The Use of the Synchronized Double Spark.

Gazz. chim. ital., 79, 344-64 (1949).

C. A., 43, 8953d (1949).

The method of Gerlach and Schweitzer (Die chem. Emissionsspektralanalyse Grundlagen und Methoden. 1930, I, p. 79) (*C. A.*, 24, 554) was improved by the use of a double spark, one analytical, the other Cu, induced alternately by a single generator and rotating commutator. A method for prep. alloys from pure Al and Ga is described, whereby the metals were fused in a current of H in a spectroscopically pure graphite crucible in an iron tube, with agitation by an external magnet. The efficiency of the agitation was proved by checking polarographically and spectrographically the homogeneity of mixts. obtained by adding Cu to Al. The interval of concns. of the Al-Ga alloys was 0.011 to 1.96 g. %. The deficiency of spectroanalytical Al lines in the zone concerned made essential the use of an auxiliary (Cu) superposed spectrum. This was accomplished by a synchronized commutator-interrupter for inducing an Al spark at the point of max. ten-

sion, and a subsequent Cu spark. The optimum point of substitution of Al lines by Cu lines corresponding to the autoinduction for which the $\Delta S/(\Delta I)$ values for a group of lines of the Al and Cu arcs were the same was established. This comparative spectrophotometric method, when applied to Cu, made possible the construction of a diagram in which the log of the intensity of the Ga lines, measured graphically in relation to a known Cu line, and to the same attenuated to 25%, was a linear function of the log of its concn. Under the operating conditions finally adopted as little as 0.008% Ga in Al can be detd. with a precision of $\pm 4\%$. The m.p. of pure Ga is 29.92°.

3253. RODRÍGUEZ-PÉREZ, A.

The Use of Salt Mixtures in Quantitative Spectrographic Determinations. II.

Anales real soc. españ. fis. y quim. 45B, 1405-12 (1949).

C. A., 46, 371h (1952).

The spectrograph is described and the working conditions are outlined for the detn. of various pairs of elements in alloys and salts. Data are presented on the pair Pb-Cd which indicate a high sensitivity.

3254. ROLLWAGEN, W.

Emission Spectral Analysis. A Critical Review of the Content of German Publications During 1939-1946.

Spectrochim. Acta., 3, 603-15 (1949).

C. A., 43, 8297g (1949).

A review of 106 German papers.

3255. ROLLWAGEN, W.

New Apparatus for Single Analyses by Emission Spectrography.

Optik, 5, 395-405 (1949).

Spectrochim. Acta, 4, 186 (1950) (an abstract).

Three types of analytical work are envisaged under the general heading of "single" analysis (as distinct from the routine analysis of many samples of the same bulk composition): (1) *Semiquantitative analysis*—the estimation of the order of magnitude of the components of a sample. Except in certain cases, visual estimation by means of a lens is often sufficient when tables of homologous pairs are available. A viewing desk with interchangeable accessory units, viz.: lens for viewing, projection comparator and photometer (densitometer), which are described, provides just the type of equipment for this work. (2) *Preliminary analysis*. This is very useful as a preliminary to complete chemical analysis. (3) *Trace analysis*. The spectrographic method is eminently suitable for the detection of small quantities of many elements, especially when devices are available to facilitate the identification of the most persistent lines—in which case the examina-

tion can be made almost automatic. The following innovations in equipment are described and fully illustrated: (1) *Spectrograph and source unit*. For the excitation of the spectra a spark source is built in under the table carrying the electrode stand and the projection and intermediate lenses. A hanging (vertical) mounting of the spectrograph gives economy of space, and the camera dark slide can be replaced by a viewing box for visual examination of the spectra. (2) *Viewing box*. Provision is made for the insertion of a slide carrying a positive copy of a spectrum, which is independently illuminated. This copy lies exactly in the focal plane for comparison with the spectrum under examination. (3) *Evaluation of the spectra*. The spectrum viewing stand can be adapted for visual examination of spectrograms with a lens, to give a projected image or to take a photometer attachment for density measurements. This provides a very flexible unit for qualitative and quantitative evaluation of the spectra.

3256. ROLLWAGEN, W. AND WELTZ, H.

Comparison of Line Blackening and Line Width Difference Methods in Quantitative Spectrochemical Analysis.

Z. Naturforsch., **4a**, 570-3 (1949).

C. A., **44**, 4365a (1950).

Both methods are based on internal standards. The former depends on the proportionality of the difference in blackening of 2 lines to the log of their intensity ratio, the latter on the fact that the width of the stronger line, measured at the place where its blackening is equal to that of the weaker line at its center of gravity, provides a criterion of their relative intensities. The width method is of special advantage whenever one of the lines exhibits strong self-reversal, or when the characteristics of the photographic plate were not detd. exactly.

3257. ROSENQVIST, I. T.

Cobalt Ore Mines of the Modum District, Southern Norway. I. The Fahlband Ores.

Norsk. Geol. Tids., **27**, 187-216 (1949) (English Summary).

Mostly mineralogical (c.f. *C. A.*, **43**, 8316 (1949)) but many analytical data are given on Co, Ni, Cu, Ag, Sb, and Bi in the different rocks.

3258. ROST, F.

The Serpentine-gabbro Occurrence of Wurlitz and Its Minerals.

Heidelberg. Beitr. Mineral. Petrog., **1**, 626-88 (1949).

C. A., **44**, 494i (1950).

Spectrographic detns. are given for many rocks and rock minerals of the contents of Ni, Co, Mn, Cr, Sc, and V, and Ti. The transfer

of these elements during metamorphic changes is discussed.

3259. ROST, F.

Spectral-analytical Determination of Iron in Zinc Blende.

Spectrochim. Acta, **3**, 569-74 (1949).

C. A., **43**, 8303g (1949).

For the spectrochem. estn. of Fe in ZnS ore an enriched arc between C electrodes is used. Pulverized ore samples, mixed with equal amts. of C, are placed in a bored cathode and completely burned in a d.-c. arc with 2-6 amp. Rapid analysis with a standard deviation of about 10% is possible.

3259a. ROZENBERG, I. V.

Determination of Small Amounts of Iron in Metallic Magnesium.

Zavodskaya Lab., **15**, 944-5 (1949).

C. A., **47**, 3176g (1953).

Small amts. of Fe in metallic Mg were detd. with a quartz spectrograph of medium dispersion and Svetnitskii arc as source. Standards were metallic Mg contg. 0.001-0.01% Fe and were analyzed by colorimetric, volumetric, and polarographic methods. Fe lines 3581.2, 2382.0, and 2395.6 Å were used as well as Mg lines 3330.0 and 2782.98 Å.

3260. ROZSA, J. T.

Spectrographic Analysis of Ductile Cast Iron.

Iron Age, **164**, No. 25, 73-5 (1949).

C. A., **44**, 1359g (1950).

Wet analytical or colorimetric methods for detg. small quantities of Ce and Mg in Fe are difficult and time consuming. A spectrographic method has been developed which permits 4 or more detns. in duplicate to be made within an hr. at a resultant low cost, and involves no facilities not found in the usual spectrographic lab. By suitable sampling and use of spark rather than arc, Mg can be detd. in the range 0.005 to 0.10%.

3261. SÁNCHEZ SERRANO, E.

Auxiliary Ionization in Spectrochemical Analysis.

Congr. groupement avance. méthod. anal. spectrograph. produits mét., **12**, 141-8 (1949); *Rev. geofis. (Inst. nacl. geofis.)*

(Madrid), **8**, 388-403 (1949).

C. A., **45**, 3750i (1951).

Radioactive materials and gas from a small flame were equally satisfactory for producing auxiliary ionization in the vicinity of the spark electrodes. Statistical criteria established the reproducibility of the results in which the first method was used. Max. sensitivity to some lines was obtained when electrodes were prepd. from Sn, Pb, and alloys of Zn, and the ionization produced by the flame.

- 3261a. SÁNCHEZ SERRANO, E.**
Radioactive Ionization and its Application to Spectrochemical Analysis.
Bol. radiactividad (Madrid), 22, 278-93 (1949).
C.A., 47, 11069e (1953).
A review with 49 references.
- 3262. SAWYER, R. A.**
Spectroscopy: Tool for Science and Technology.
Physics Today, 2, No. 4, 8-15 (1949).
C. A., 43, 4096e (1949).
The historical development, with a summary of its present status.
- 3263. SCHMIDT, R.**
Breckpot Calculator for Calculating Efficiency Differences—Systematic Error Introduced by Curvature of Sector Curves.
Rec. trav. chim. Pays-Bas, 68, 547-52 (1949) (in English).
C. A., 44, 10487e (1950).
The use of the Breckpot calculator (cf. *C. A.*, 34, 1574⁷), for computation of efficiency differences of spectrum lines in step-sector spectra is valid only for rigorously linear sector curves. In other cases a graphic method must be used.
- 3264. SCHMIDT, R.**
The Inherent Precision of Spectrochemical Computation Methods.
Spectrochim. Acta, 3, 538-45 (1949).
C. A., 43, 8276f (1949).
The object of this study was to ascertain whether the principal methods of computation used in photographic spectrochem. detns. differ in inherent precision. Five well-known methods of computation are compared, viz. (1) density difference; (2) integral emulsion calibration; (3) step sector; (4) the Scheibe 2-line procedure; and (5) the Scheibe 3-line procedure. The precision of all methods compared has a max. value, which is the precision of the detn. of the density difference of the homologous pair. Therefore, the method of the simple d. difference is inherently the most precise; its inherent precision is practically equalled by the integral calibration method. This max. value is virtually reached by the other methods if a gamma value is used that is the mean of at least 4 independent detns.
- 3265. SCHMIDT, R.**
The Reliability of Chemical Analysis.
Congr. groupement avance. méthod. anal. spectrograph. produits mét., 12, 93-8 (1949).
C. A., 45, 3749h (1951).
The methods of math. statistics in the design as well as in the evaluation of an expt. should be used in developing reliable analytical methods for practical purposes. This is of particular importance in the analysis of standards for spectrographic analysis.
- 3266. SCHNEIDERHÖHN, H., CLAUS, G., LEUTWEIN, F., PRELL, G., SCHINZINGER, A., AND SPITZ, W.**
The Occurrence of Titanium, Vanadium, Chromium, Molybdenum, Nickel, and Some Other Trace Elements in German Sedimentary Rocks.
Neues Jahrb. Mineral., Geol., Monatsh., 1949A, 50-72.
C. A., 43, 8996a (1949).
A summary of chem. and spectrographic analyses of 885 samples of 54 groups of rocks, with graphical representation of a few of the analyses. Certain black shales were particularly high in trace elements.
- 3267. SCHNOPPER, I. AND ADLER, I.**
Quantitative Spectrochemical Determination of Lead and Zinc in Ores.
Anal. Chem., 21, 939-40 (1949).
C. A., 43, 8954b (1949).
Ground ore samples were mixed with a buffer consisting of C and Li_2CO_3 and packed in graphite electrodes. Exposures were made with carefully controlled arc conditions. Analyses were made with working curves obtained from standard samples. Results were accurate to about 0.06% for concns. up to 1%.
- 3268. SCHOFFSTALL, D. G.,**
Spectrographic Analysis of High-alloy Steels.
Elec. Furnace Steel Conf., Am. Inst. Mining Met. Engrs., *Proc.*, 7, 122-4 (1949).
A brief discussion of the analysis of low alloy and high alloy steels for Mn, Si, Cr, Ni, No, V, W, Cu, Al, Sn, and Co in concentration ranges not exceeding 5.0%. The second or third order of a large grating spectrograph is used for determining Mn and Si in stainless steel, thus avoiding interference from chromium. The relative costs of the spectrographic and chemical determinations are discussed, the spectrographic being about half that of the chemical determinations.
- 3269. SEITH, W. AND RUTHARDT, K.**
Anleitungen für die chemischen Laboratoriumspraxis. Bd. I. Chemische Spektralanalyse, 4th ed. Berlin: Springer-Verlag (1949), 173 pp. D.M. 16.50
C. A., 44, 446b (1950).
Compared to the earlier edition of 1944, this compact and informative textbook covers the more recent literature, and includes several new sections. These are as follows:

use of Seidel functions and calculating boards in photometry; non-destructive testing, particularly of tool steel; absorption spectra of gases; and a unique six-page section of technical terms of spectrochemical analysis in German, French, and English. Reviewed in *Spectrochim Acta*, **4**, 307 (1951).

3270. SHAVRIN, A. M.

Spectrochemical Determination of Vanadium in Cupriferous Sandstones.

Zavodskaya Lab., **15**, 66-9 (1949).

C. A., **44**, 72e (1950).

Standards quartz contg. 3% Mo as $(\text{NH}_4)_2\text{MoO}_7$ was used as internal standard; the samples were mixed with 1 part of quartz before analysis. Results obtained with the intermittent low voltage a.-c. arc, with the intensity ratio V 3110/Mo 3112, agreed best with chem. analysis when the V was introduced into the standards as $3 \text{ CuO} \cdot \text{V}_2\text{O}_5 \cdot 4\text{H}_2\text{O}$ or NH_4VO_3 . The probable error for a single detn. was 5-13%.

3271. SIHVONEN, Y. T., FRY, D. L., NUSBAUM, R. E., AND BAUMGARTNER, R. R.

Spectrographic Analysis of High-cobalt (Vitalium) Alloys.

J. Optical Soc. Am., **39**, 257-60 (1949).

C. A., **43**, 4181g (1949).

A spectrochem. method of analysis was developed for control purposes in casting Vitalium—an alloy contg. Co 63.0 to 66.0, Cr 27.0 to 28.5, Mo 5.35 to 6.00, Ni 1.60 to 3.20%, and smaller quantities of Si, Mn, and Fe. The spark spectrum of polished one-inch rounds was photographed and six elements were detd. from intensity ratios of analysis and internal standard lines compared with similar data on chemically analyzed samples. The standard deviation ranged from 4 to 11%.

3272. SINCLAIR, D. A.

Characteristics of Pulsed Arcs in Spectrochemical Analysis. I. Zinc Alloys.

J. Optical Soc. Am., **39**, 958-66 (1949).

C. A., **44**, 379h (1950).

A study has been made of the variations of some spectrochemically significant properties of pulsed arc discharges produced by a condensed arc source unit (*C. A.*, **42**, 5280a). Quant. responses of sensitivities, line ratios, and electrode heating to changes in pulse form have been detd. This survey does not point to any unique combination of circuit values as best for spectrochem. analysis of zinc alloys.

3273. SINGH, R.

Qualitative and Quantitative Analysis of Ceramic Raw Materials and Products by Spectroscopic Methods.

Trans. Indian. Ceram. Soc., **8**, 54-60 (1949).
C. A., **44**, 3225d (1950).

Descriptive of well-known instruments and methods and a list of applications to glass and ceramic problems.

3274. SMITH, A. L. AND FASSEL, V. A.

Spectrographic Determination of Impurities in Beryllium and Its Compounds.

Anal. Chem., **21**, 1095-8 (1949).

C. A., **43**, 8949f (1949).

A method for the simultaneous detn. of Al, Ca, Cr, Fe, Mn, Mg, and Si in Be and its compds. requires conversion to BeO , addn. of powd. graphite, SnO_2 , and $\text{Ba}(\text{OH})_2$, and excitation in a 16 amp. d.-c. arc. The Sn and Ba serve as internal standards.

3275. SMITH, D. M.

Application of Stigmatic Spectra to the Study of an Arc Discharge.

Congr. groupement avance. method. anal. spectrograph, produits met., **12**, 129-35 (1949).

C. A., **45**, 3751e (1951).

Successive exposures of stigmatic spectra and vapor resistances as indicated by the arc voltages were used to identify the impurities in Ag pellets mounted on a continuously cooled graphite electrode. The following sequence of excitation was obtained with an increase in arc voltage: Cs>Na>Pb, Sn, Bi, Mn, Te, Ti>Ag, Se>Cu, Zn, Al>Fe>Ni, Au>(TiO₂), (Al₂O₃). The introduction of a readily ionizable material such as NaCl at the electrodes increased the sensitivity in detecting trace elements with low vapor resistances. By using relatively impure graphite, the trace impurities normally encountered in the highly purified material were more readily identified.

3276. SMITH, D. M.

Industrial Spectroscopy. A Review of Modern Methods and Equipment.

Metal Ind. (London), **75**, 140-50 (1949).

C. A., **44**, 423c (1950).

3277. SMITH, D. M. AND WIGGINS, G. M.

Analysis of Rare Earth Oxides by Means of Emission Spectra. I. Persistent Lines

in Arc Spectra of Rare Earth Elements. *Analyst*, **74**, 95-101 (1949).

C. A., **43**, 5337g (1949).

The persistent lines of Ce, Dy, Er, Eu, Gd, Ho, La, Lu, Nd, Pr, Sm, Tb, Tm, Yb, and Y were detd. There are 5-9 lines for each element. The identification of certain faint lines in the published spectra of rare earth elements present as impurities are discussed. See also Wiggins, G. M., 1949.

3278. SMITH, G. S.

Spectrochemical Analysis. Technique for Determining Composition of Alloy Solutions.

Metal Ind. (London), **75**, 267-8 (1949).

C. A., **44**, 975d (1950).

To det. Be, dissolve 0.1 g. of alloy in dil. HCl, add CdCl₂ soln. contg. 0.5 mg. of Cd. and transfer the 5 ml. of the soln. to an electrode cup and compare the intensities of the lines Be = 2348.6 Å and Cd = 2288.0 Å. Empirical graphs are used for estg. the concn.

3279. SPICER, W. M. AND ZIEGLER, W. T.

Spectrochemical Determinations of Lanthanum in Praseodymium Metal.

Anal. Chem., **21**, 1422-3 (1949).

C. A., **44**, 1847c (1950).

A sample of supposedly pure Pr metal was suspected to be grossly contaminated with La. It was decided to analyze spectrographically for La with Mn 3438.974 Å as an internal standard. With mixts. of pure La and Mn chlorides and Cu electrodes, intensity ratios of this line and La 4086.7 Å gave a linear log-log working curve. Closely agreeing results on the Pr metal gave an av. La content of 37.0%. This figure was later verified by chem. assay.

3280. SPINEDI, P., FONGI, N., AND STEIN, A. M.

Analysis of Iron-bearing Sands.

Ann. chim. applicata, **39**, 555-71 (1949).

C. A., **45**, 5071d (1951).

A systematic analytical sepn. procedure for magnetic fractionation of ferrous sands is given. Detection and detn. of minor constituents such as rare earths, W, Mo, V, Ti, and Zr, are described. The procedure comprises screening to 500-600 mesh (per sq. cm.) and electromagnetic sepn. yielding two fractions. The magnetic portion is analyzed spectrographically for W, Mo, Ti, and V, the nonmagnetic portion is sepd. by d. in a light fraction (discard) and a heavier one, in which third-group elements are pptd. from HCl ext. as oxalates and after calcination analyzed spectrographically.

3281. STANFORD, G. AND ENGLISH, L.

Use of the Flame Photometer in Rapid Soil Tests for Potassium and Calcium.

Agron. J., **41**, 446-7 (1949).

C. A., **43**, 9318e (1949).

The method described gives a degree of accuracy comparable to that of more precise chem. methods. The acetylene flame is used for both Ca and K detns. The high Na concn. of the soil ext. does not interfere with the operation of accuracy and reproducibility of the detns.

3282. STECHER, R. M., BEDELL, H. M., AND LEWIS, I.

Quantitative Spectrographic Analysis of Blood and Tissue Fluids.

J. Lab. Clin. Med., **34**, 616-24 (1949).

C. A., **43**, 7071h (1949).

Fe, Na, Mg, and Pb in as little as 0.02 ml. of biol. materials can be quant. detd. with electrical excitation. Org. materials are destroyed by HClO₄-HNO₃ digestion, and the residue is burned in an elec. arc. The specific monochromatic radiation produced by each metal present is recorded on photographic film. The intensities of element lines are compared to a standard film and densities measured by microphotometer. Use of an internal Cd or Bi standard, in various ranges, increases the accuracy. The reproducibility of Fe is within 5%; Na 7%. In a micro-method, 0.02 cc. blood is added to a cupped electrode, and 0.02 cc. conc. perchloric acid containing 4 g. Cd acetate is added. The electrode is heated by infrared lamp for 30 min. Dry ashing is better. A small piece of ashless filter paper is added to graphite cup, and 0.02 cc. blood and 0.02 cc. Cd acetate soln. are added. Electrode placed in oven for 1½ hr. at 850°. One drop HNO₃ is added before exposure in order to prevent loss of powder. In another method Li₂CO₃ is added to cup on top of ash.

3283. STEINBERG, R. H. AND BELIC, H. J.

Silica Refractories. Spectrographic Analysis with the Direct-current Arc and High-voltage Spark.

Anal. Chem., **21**, 730-1 (1949).

C. A., **43**, 7656d (1949).

Silica brick is analyzed spectrochemically for Al₂O₃, TiO₂, K₂O, and Na₂O. In analyzing for the alkalis, 1 g. of silica brick (ground to pass 80-mesh), 0.6 g. graphite, and 0.1 g. BaCO₃ are ground in an agate mortar and compressed into briquets at 250,000 psi. The pellet is held in the tubular lower (+) electrode of a d.-c. arc with a graphite counter electrode. Ratios of intensities of the alkali to a Ba spectrum line are used for the analysis. Ti and Al are analyzed spectrographically with a Feussner type spark excitation. Silica brick is packed into a hollow C rod, cemented with 2 drops 2% Ethacel in BuOAc, and dried in a stream of air. A graphite counter electrode is employed, and Si lines are used as an internal standard.

3284. STRASHEIM, A.

Application of Spectrochemical Analysis in Fruit Research.

Union S. Africa Dept. Agr. Sci. Bull., No. 295, 12 pp. (1949).

C. A., **45**, 2543c (1951).

Essentiality of various elements, particularly trace elements, to plant growth is discussed. Spectrographic accuracy is illustrated by spectrographic results for Al, Cu, Fe, Mn, Pb, Zn, and B in synthetic soln., and by spectrographic results for P, contrasted with chem. results, in the analysis of wheat and phosphate rock. Spectrographic methods can be used to trace variations in the ash constituents of a fruit during ripening. Proper Mn treatment of peach orchards can be checked by spectrographic analysis for Mn of the air-dry foliage. Best yields were obtained when the leaves contained 66 ppm. The spectrographic method can be used for rapid evaluation of Mn, Cu, B, Fe, Al, Ca, and Mg content of the citric acid ext. of soils.

3284a. SUKHENKO, K. A. AND MLADENTSEVA, O. I.

Spectroanalysis of Nickel Alloys.
Zavodskaya Lab., 15, 946-50 (1949).
C. A., 47, 3181f (1953).

A systematic study was made of effects of various exptl. factors on detns. of Cr, Ti, Fe, Al, Si, and Mn in Ni alloys. Best results are obtained with a Ni support electrode, spark gap of 1.8 mm., and ordinary type spark; an a.-c. arc with breaker gave somewhat less accurate results. A medium-type quartz spectrograph is satisfactory.

3285. TAGANOV, K. I.

Spectrum Analysis of Metallic Coatings.
Zavodskaya Lab., 15, 695-700 (1949).
C. A., 44, 483b (1950).

Directions for the use of Soviet-made ISP-22 model spectrograph in the analysis of metal coatings.

3286. TIMMA, D. L.

Spark Spectra of Elements 43 and 61.
J. Optical Soc. Am., 39, 898-902 (1949).
C. A., 44, 427i (1950).

The blue and ultraviolet spark spectra of elements 43 and 61 were detd. from samples sepd. from U-fission products at the Oak Ridge National Lab. Small samples from dil. HCl solns. were dried on Cu electrodes, excited by a controlled spark, and the spectra were photographed with a grating spectrograph of 150 cm. radius. For element 43 the wave lengths (4297.2 to 2461.7 Å) and intensities (10 to 100) are given for 100 lines but more than 40 of these are interfered with by Ru and Re impurities. The following lines, detectable with 1 γ or less, are recommended for identification of element 43: 4297.2, 4261.9, 4095.3, 4088.4, 4031.3, and 3237.0 Å. For element 61 the wavelengths (4381.9 to 3629.8 Å) and intensities (10 to 100) are given

for 59 lines with interference from Nd and Fe indicated for about 20. Because of their intensity and freedom from interference the best lines for the identification of 61 are stated to be 4086.0, 3980.6, 3910.4, and 3711.7 Å, which, it is estd. are detectable with 0.1 γ .

3287. TOMKINS, F. S. AND FRED, M.

The Spectra of the Heavy Elements.
J. Optical Soc. Am., 39, 357-63 (1949).
C. A., 43, 5304c (1949).

The spectra of the heavy elements, Pa, Np, Pu, and Am, like those of Th and U, are characterized by great complexity. Consequently, descriptions of the spectra which are to be adequate for term analysis and assignment of electron configurations must be very extensive, contg. accurately detd. wavelengths and other data. Because considerable effort and amts. of sample are required for these it will be some time before such descriptions are available. On the other hand, it would be useful for spectrochem. analyses to have wave lengths of prominent lines to 0.1 Å and intensities in a convenient spectral region. The no. of lines and wavelength limits here given are as follows: 283 lines of Pa 2640.3 to 4371.7 Å, 114 lines of Np 2655.0 to 4363.8 Å, 220 lines of Pu 2677.0 to 4358.1 Å and 227 lines of Am 2661.6 to 4374.9 Å. The line intensities are proportional to the reciprocal of the limiting dilns. at which they could be photographically recorded with a Cu spark source and a 3-meter grating spectrograph. It appears that the spectrum of Am bears the same relation to those of the other heavy elements that the spectrum of Eu does to those of the preceding rare earths; both elements have a few lines of outstanding intensity. This suggests by analogy that Am has 7 *f* electrons and 2 *s* electrons.

3288. TRICHÉ, H.

A Spectrographic Study of the Distribution of the Elements Between the Phases of an Alloy.

Congr. groupement avance. méthod anal. spectrograph. produits mét., 12, 31-50 (1949).

C. A., 45, 3784e (1951).

The distribution of elements in the α - and β -phases of brass and white pig Fe was studied by the direct arcing method previously applied to Zn or Sn-Cd alloys (cf. *C. A.*, 43, 5694c, 8949h). Impurities of Pb, Al, Ca, Fe, Sn, Mn, and Ag were observed. A comparison of the spectra of a polished surface of pig Fe with that of cementite showed certain Fe lines to the reënforced. A theoretical interpretation of this anomaly and a review of factors influencing emission spectra are presented.

3289. TRICHÉ, H.

The Distribution of Elements Between the Phases of an Alloy. The Influence of Cementite on the Relative Intensities of Iron Lines.

Compt. rend., 229, 652-3 (1949).

C. A., 44, 1872f (1950).

The relative intensities of Fe lines in the spark spectra of white cast iron were higher for etched than for polished samples. This is ascribed to the removal of cementite from the former by the action of the spark and the subsequent impoverishment of the surface in C.

3290. VANCE, E. R.

Direct-reading spectrometer.

J. Metals, 1, No. 10, 28-30 (1949).

C. A., 43, 8944g (1949).

A report by the Timken Roller Bearing Co., Canton, Ohio, that has used this new method for over two years.

3291. VANCE, E. R.

Melting Control with the Direct-reading Spectrometer.

Elec. Furnace Steel Conf., Am. Inst. Mining Met. Engrs., *Proc.*, 7, 107-10 (1949).

A general discussion of experiences with control of steel production by a direct-reading spectrometer. Savings in costs are stressed. The elements determined are Mn, Si, Cr, Ni, Mo, Cu, V, W, Al, and Sn. The highest concentration determined is chromium at 7%. The dependability of the instrument is considered good. A comparison of the accuracy of spectrographic and spectrometric methods shows the latter superior for most elements. In addition to a heavy work load in control analyses, the spectrometer is also used to separate mixed bars and billets.

3292. VAN DER MERWE, J. H.

Spectrographic Determination of Zinc in Plant Material.

Union S. Africa Dept. Agr. Sci. Bull. No. 277, 24 pp. (1949).

C. A., 44, 8281i (1950).

The dried plant material is prepd. by ashing and then fusing with Na_2CO_3 . HCl is added to produce a soln. Fe is added at this point to act as an internal standard. Then, after the soln. is made thoroughly acidic with HCl, the trace elements are pptd. by 8-quinolinol in AcOH. NH_4OH is added until the soln. turns green. NH_4OAc is then added and the Fe and trace elements are pptd. After washing and filtering, the ppt. is ashed and mixed with C powder. A c.d. of 4 amp. is used and a d.-c. arc 6.5 mm. wide.

3293. VANSTONE, F. H. AND PHILCOX, H. J.

Flame Method of Spectrographic Analysis.

Ann. Rept., East Malling Research Sta., Kent, 1949, 105-10.

C. A., 46, 7152b (1952).

The dried, ground plant material (15 mg.), for flame-spectrographic analysis, is pressed into a length of 4.5 mm. in a cellophane tube, 2.5 mm. in diam. and 1 cm. long, the remainder of the tube being filled with cellulose powder. When the tube is automatically fed into an oxy-acetylene flame, 4×10^{-9} g. of Cu, Mn, and (or) Rb can easily be detected with an exposure of 8 sec. The construction and operation of appliances for forming and packing the tubes, and for feeding them into the flame, under reproducible conditions, are described.

3293a. VESELOVSKAYA, I. M.

Spectral Analysis of Ferrosilicon.

Zavodskaya Lab., 15, 940-4 (1949).

C. A., 47, 3181e (1953).

Ferrosilicon of nonuniformity (up to 15-20%) and contg. up to 75% Si was averaged by briquetting with a Cu powder bond and then analyzed with a spectrograph of medium dispersion and a slit width of 0.25 mm. A Raikii condenser spark setup was used as source. Intensity of lines was measured on an MF-1 microphotometer. Si line 2987.65 Å was used with Cu lines for comparison. Mn and Al in the alloy were also detd. The method can be used for Mn and Al detns. and for Si under certain conditions (production) but Si detns. are not as good as by a chem. method.

3294. VIGHI, L.

Plutonites of Mt. Sila and Serra S. Bruno, Calabria.

Mem. e note ist. geol. applicata univ. Napoli, 2, 119-34 (1949).

C. A., 46, 4967i (1952).

Chem. analyses and petrographic data are given for 2 rocks. Minor elements (amts. estd. spectrographically) were Ba, Sr, Cr, Rb, Cd, W, Co, Ni, Zn, Ag, Cu, Li, V, Sn, Pb, Mn, Pt, Ge, B, and Be. The rocks can be classified as quartz monzonites.

3295. VINOGRADOV, A. P. AND BERGMAN, G. G.

Chromium and Vanadium in the Soils of the Soviet Union.

Pochvovedenie (Pedology), 1949, 569-73.

C. A., 44, 4615b (1950).

In soils of the tundra zone there is more V than Cr, probably because of the nepheline syenite. There is more V and Cr in the upper than in the lower horizons. There seems to be more V in the tundra soils than in many soils of the other soil groups. The sod-podzolized soils on clay lenses contain more Fe and correspondingly more Cr than the soils on boulder clay. There is more Cr than

V in these soils. There is a more or less uniform content of V in the profile. There is a definite concn. of Cr and sometimes of V in the B horizon. In the gray forest soils there is a concn. of V and Cr in the B horizon. Chernozem soils contain relatively more Cr and V than the other zonal soils. There is a concn. of Cr and V in the upper horizon, with slightly more Cr. The chestnut-brown and gray semidesert soils have more Cr and V. The red loams, in spite of the high Fe content, contain small amts. of Cr. The V content is higher than in any of the soil groups. In general, the Cr content is higher than that of V. The av. of all soils is: Cr 1.9×10^{-2} and V 1×10^{-2} . Tabular data are given on the Cr and V contents of the profiles of the zonal soils in Russia as well as the soils in the U. S., France, England, Germany, and Japan.

3296. VOJNAR, A. O. AND RUSANOV, A. K.
Chemical Topography of the Trace Elements in the Brain of Man, According to Spectroscopic Analysis.
Biokhimiya, 14, 102-6 (1949).
Fisiol. e med. (Rome), 17, 127-34 (1949).
C. A., 43, 6719g (1949).

The amt. and distribution in the brain of the following trace elements (elements which form less than 1% of the ash) have been detd. by their emission spectra: Ag, Al, Bi, Cr, Cu, Mn, Mo, Ni, Pb, Si, Sn, Ti, V, and Zn. Sections of the brain which differ in morphological structure and physiol. function possess a different chem. compn. of the trace element.

3297. WALKER, F. AND POLDERVAART, A.
Karoo Dolerites of the Union of South Africa.
Bull. Geol. Soc. Am., 60, 591-706 (1949).
C. A., 43, 6128d (1949).

An exhaustive study of the geology, petrology, and mineralogy of the Karoo dolerite with 25 analyses of related or assocd. rocks and 88 (of which 18 are previously unpublished) of dolerite, with extensive mineralogical data and many modes.

3298. WALTZ, E. O.
Spectroscopy at Canton Div., Republic Steel Corp.
Elec. Furnace Steel Conf., Am. Inst. Mining Met. Engrs., *Proc.*, 7, 127 (1949).
A brief note on the advantages of the spectrograph in control of steel production, with information on costs of analyses.

3299. WEAVER, J. R. AND BRATTAIN, R. R.
A Common-matrix System of Spectrochemical Analysis.
Anal. Chem., 21, 1038-41 (1949).
C. A., 43, 8945a (1949).

A survey of the burning characteristics of several alk. borates, fluorides, phosphates,

and carbonates indicated Li_2CO_3 to have excellent spectrochem. flux properties. One part sample +9 parts Li_2CO_3 + ~0.8 mg. of purified gentian violet are ground together; attainment of a uniform color indicates the mixt. is homogeneous. Samples are burned to completion in a shallow, center-post graphite electrode, and quant. estimates are made from working curves. Ninety-one % of results were correct to within a factor of 2.

3300. WEICHELBAUM, T. E. AND VARNEY, P. L.
A New Method of Flame Photometry.
Proc. Soc. Exptl. Biol. Med., 71, 570-2 (1949).
C. A., 43, 8217e (1949).

A new type of atomizer-burner system is described which accomplishes consistently accurate detns. of Na, K, and other cations.

3301. WERNER, O.
Spectrochemical Analysis.
Z. Ver. deut. Ing., 91, 827-33 (1949).
C. A., 44, 6759d (1950).

Spectral analysis proved excellent in the rapid examn. of debris metals, and in the identification of displaced tool steels. The qual. and semiquant. methods are particularly useful. A description of equipment and procedures is given.

3302. WIGGINS, G. M.
Analysis of Rare Earth Oxides by Means of Emission Spectra. Part II. A Technique for the Suppression of Cyanogen Bands in Carbon Arc Spectra of Rare Earth Oxides.
Analyst, 74, 101-104 (1949).
C. A., 43, 5337g (1949).

The use of an atmosphere of steam around the d-c arc to suppress the CN bands from the graphite electrodes is described. In addition, sodium silicate is added to the electrode to produce more uniform volatilization of the rare earth sample.

3303. WILLEBRANDS, A. F., JR.
Determination of Sodium and Potassium in Blood Serum and Urine by Means of the Flame Photometer.
Nederland. Tijdschr. Geneeskunde, 93, III, 2351-6 (1949).
C. A., 44, 185c (1950).

Serum or urine is dild. with distd. water up to 100 times, and sprayed into a colorless flame. Special photoelec. cells are used for photometric detn. of Na and K. The cell used for Na is most sensitive in the region of 5890-6 Å, the one for K in the region of the K lines, 7665-99 Å. The accuracy of detn. is 1-2 mg. per l. of serum or urine.

3304. WINDLE, M. L. AND MAGRUN, W. H.
Use of the Spectrograph in the Analysis of Special Steels.

Elec. Furnace Steel Conf., Am. Inst. Mining Met. Engrs., *Proc.*, 7, 119-21 (1949).

The precision of the spectrographic control analysis of steel is discussed and sources of errors are considered. Low and high alloy steels are included. The determination of 35% cobalt in steel is stated to be highest in accuracy. Advantages, including savings in costs, are considered.

3305. YOUNG, L. G.

Spectrographic Analysis of Very Small Samples of Steel.

Engineer, 187, 589-91 (1949).

C. A., 43, 6541c (1949).

Steel samples weighing as little as 5 mg. can be analyzed for all the usual elements except P and S within an hr. The sample is pressed into the prepd. surface of a Ag rod which is held in the lower electrode holder. The sample is submitted in succession to a spark and then an arc discharge with a Ag counter electrode. The resulting spectrograms are evaluated, 1st examg. the arc exposure for impurities by the usual visual internal comparison method, and then evaluating the spark spectrogram by a new method of internal comparison. In the latter the d. of an element line is correlated with the ds. of a no. of nearby Fe lines.

3306. ZACHARIASON, R. H.

Analysis of Residual Gas in Electron Tubes with Light Spectrograph.

Anal. Chem., 21, 1285-6 (1949).

C. A., 44, 424c (1950).

Unwanted gas in electron tubes is identified spectrographically. The gas spectrum is excited within the tube by one of 3 methods: (1) Tesla coil excitation, (2) a high voltage

applied between 2 terminals of the tube, and (3) electron-beam excitation in cathode-ray tubes.

3307. ZAGORYANSKAYA, E. V.

Investigation of Spectrum Excitation Conditions in the Controlled Spark Source.

Zavodskaya Lab., 15, 53-9 (1949).

C. A., 44, 35d (1950).

Abs. and relative intensities, electrode temps., analytical gap voltages, current, and spark temps. were observed as a function of time for several arc and spark lines of Fe, Cr, V, Si, Mg, and Al with an uncontrolled spark source, and one in which triggering was provided by an auxiliary high-frequency fixed-gap spark circuit inductively coupled into the main circuit. With steel electrodes, the triggered source gave more stable intensity ratios and gap voltages than did the uncontrolled source; with Duralumin electrodes, there was little difference between sources. Sparking-off effects are not primarily due to heating up of the electrode, and are not eliminated by keeping gap voltage and amperage const. The temp. of the spark itself is const. throughout the exposure.

3308. ZHURAVLEV, G. I. AND MALYAVKIAN, V. P.

The Effect of Alloying Components on the Aluminum Spectrum.

Zavodskaya Lab., 15, 115-17 (1949).

C. A., 44, 35c (1950).

A study was made of the influence of the addn. of Mn, Mg, Fe, Si, Cu, and Zn on the d. differences obtained for various pairs of Al lines. Of the 8 lines studied, Al 2816.2 Å was the only one whose intensity was affected by alloying elements. D. differences involving this line were increased 0.1-0.3 by the addn. of 5% of the elements listed to the Al. A previously unlisted Mn line was found at 3050.512 Å.

1950

- 3308a. ABRAMOV, V. L., BOGDANOVA, V. T., AND TAGANOV, K. I.

Spectral Analysis of Wrought Iron for Silicon and Carbon.

Zavodskaya Lab., 16, 1218-24 (1950).

C. A., 47, 3176i (1953).

A quartz spectrograph, ISP-22, and micro-photometer, MF-1, were used for the analysis. Standards were prepd. with special care to prevent sepn. of primary graphite. (1) Si detn. The sample was the lower electrode and a Cu rod was the upper electrode. The electrode gap was 3 mm., the source of light was an activated a.-c. arc, and the current was 4.5 amp. Calibration curves were plotted from the difference of darkening of the lines Si 2561.1 and Fe 2518.1. Detns.

ranged from 0.5 to 1.1% Si. (2) C detn. The sample was the lower electrode, and a Cu rod was the upper electrode. The electrode gap was 0.6 mm., the source of light was a high-frequency spark, and the current in primary wiring of the transformer was 0.8 amp. Calibration curves were plotted from difference of darkening of the lines C 2296.8 and Fe 2298.2. C detns. ranged from 2.25 to 3.25% C.

3309. ADDINK, N. W. H.

Rapid and Accurate Method of Measuring Line Intensities in Spectrochemical Analysis.

Spectrochim. Acta, 4, 36-42 (1950).

C. A., 44, 7181i (1950).

Measurement of line intensities by visual comparison with standard-density lines on photographic paper is as accurate as measurement with a densitometer (5%); it includes a correction for background intensity, and permits qual. inspection of the spectrum and the extn. of line intensities to be made simultaneously.

3310. AHRENS, L. H.

Spectrochemical Analysis.

Addison-Wesley Press, Cambridge, Mass., 269 pp. (1950).

C. A., 45, 2372c (1951).

Reviewed by W. R. Brode, *J. Opt. Soc. Am.*, 41, 485 (1951).

Reviewed by R. L. Mitchell, *Spectrochimica Acta*, 4, 425 (1951).

This book covers the d.-c. arc analysis of minerals, rocks, and soils and is applicable also to ceramic materials, refractories, slag, biological ash, and powders in general. The principles of the method are discussed with particular attention to volatilization in the d.-c. arc, selection of lines and internal standards and photometric measurements. The detection and determination are discussed for each of the chemical elements and tables of sensitive lines are given. A bibliography of about 400 references is included.

3311. AHRENS, L. H.

What to Expect from a Standard Spectrochemical Analysis of Common Silicate Rock Types.

Am. J. Sci., 248, 142-5 (1950).

C. A., 44, 4365b (1950).

A tabulation and discussion of what minor constituents and quant. precisions may be expected.

3312. AHRENS, L. H. AND GORFINKLE, L. G.
Abundance of Several Relatively Rare Elements in Igneous Rocks of North America.

Science, 112, 565 (1950).

C. A., 45, 2378g (1951).

A preliminary report of a methodical spectrochem. analysis and statistical survey on 150 rock specimens.

3313. AHRENS, L. H. AND LIEBENBERG, W. R.

Tin and Indium in Mica as Determined Spectroscopically.

Am. Mineral, 35, 571-8 (1950).

C. A., 45, 861 (1951).

Analyses are given for 61 micas. All contained Sn, the amts. ranging from 0.0005 to 0.45% SnO₂, part present as cassiterite, part in the lattice of the mica. Indium was detected in 8 samples, the max. amt. being 0.0006% In₂O₃. Mica from areas contg. cassiterite deposits were generally high in Sn content; this may be an aid in prospecting.

3314. ALEKSEBEVA, A. I. AND NAIMARK, L. E.

Spectroscopic Determination of Cadmium, Lead, and Copper in Metallic Zinc.

Zavodskaya Lab., 16, 1511-13 (1950).

C. A., 45, 10124c (1951).

Pb and Cd in the range 0.002-2.0% and Cu in the range 0.0003-0.0015% can be detd. within 5%. For low concns. of Cd the single line 2288.08 is satisfactory, along with Zn 2670.53, or better along with Zn 2138.56. For Pb all 3 lines 4057.82, 3683.74 and 2833.07 reach normal densities at 0.005% concn.; the best pair to use is Pb 2833.07 and Zn 2670.53. For Cu the 3273.96 line is inconveniently located, while the line 3247.54 reaches good intensity at 0.001% and can be paired with either Zn 2670.53 or 3018.35. Typical calibration curves are reproduced.

3314a. ALPATOV, M. S.

The Effect of Heat-treatment on the Results of Spectral Analysis of Aluminum and Nickel Alloys.

Zavodskaya Lab., 16, 40-5 (1950).

C. A., 46, 62c (1952).

No clear-cut effect on the detn. of Al, Cr, Ti, Fe, Mn, Si, Mg, Cu, or Zn was found when spectra were excited by a high-voltage spark.

3315. AMERICAN SOCIETY FOR TESTING MATERIALS.

Methods for Chemical Analysis of Metals (1950), 476 pp.

C. A., 46, 852f (1952).

Method adopted or revised since 1946 are given for: sampling of steel, cast Fe, open-hearth Fe, wrought Fe, ferro alloys, and cast or wrought nonferrous metals and alloys; for the chem. analysis of steel, cast Fe, open-hearth Fe, wrought Fe, ferro-alloys, Ni-Cr-Fe alloys, Ni, Ni-Cu alloys, Cu-Ni and Cu-Ni-Zn alloys, brasses, special brasses, and bronzes, S detn. in special brasses and bronzes, Cu (electrolytic detn. of Cu), Al and Al-base alloys, Mg and Mg-base alloys, Sb metal, pig Pb, Pb- and Sn-base solder metal, white metal bearing alloys, slab Zn (spelter), Zn-base die-casting alloys, Al detn. in Zn-base die casting alloys; for the photometric detn. of Co in Ni, of Fe in slab Zn; for the photometric analysis of Cu and Cu-base alloys, Al and Al-base alloys, Mg and Mg-base alloys, Pb, Sn, Sb, and their alloys; for spectrochem. analysis of Sn alloys and Zn-alloy die castings for minor constituents and impurities, and of Zn for Pb, Fe, and Cd; and for polarographic analysis of Pb and Cd in Zn. Recommended practices are given for photometric methods for chem. analysis of metals; app. and reagents for chem. analysis of metals; designating significant places in specified limiting values.

3316. ARGYLE, A.

Spectrographic Analysis of Magnesium in Ferrous Materials.

Brit. Cast Iron Research Assoc. J. Research and Development, 3, 521-2 (1950); (Research Rept. No. 265).

C. A., 44, 10582d (1950).

Prepn. of samples, application of the spark app. used, and nomographic evaluation of the spectra with the Mg line at 2802.7 Å and the Fe line at 2799.3 Å are described in detail. A range of 0.0015-0.15% Mg can be detd.

3317. ASTUDILLO, M. D.

Spectrochemical Analysis of the Elements Found as Impurities in Sulfides of Silver—Geochemical Consequences.

Notas y comun. inst. geol. y minero España (Madrid), 1950, No. 20, 33-44.

C. A., 45, 2823f (1951).

Forty samples of Ag sulfides from Spain, Mexico, Chile, Switzerland, Hungary, Argentina, and Bohemia were analyzed spectrographically for impurities, taking account of the relative abundance in the earth and the spectrographic sensitivity of each element. In order of decreasing frequency, the following were found: Al, Sb, and As, Pb, Cu, Zn, Mg and Mn, Ca, Fe, and Ti, Co and Ni, Sn, Si, Mo, Ba, Hg, V, and Au. Al occurred in all samples. Co and Ni occurred only when Fe was present, Ca only with Mg, As only with Sb, and Zn only with Pb.

3318. BELYANKINA, E. D.

Spectroscopic Investigation of Igneous Rocks of the Caucasus and Transcaucasus.

Trudy Inst. Geol. Nauk, Akad. Nauk S.S.-S.R. No. 121, Petrog. Ser. No. 36, 1-11 (1950).

C. A., 46, 6049g (1952).

Petrographic and spectroscopic data are given.

3319. BERL, W. G.

Physical Methods in Chemical Analysis.

Vol. I. Edited by Walter G. Berl. New York: Academic Press. (1950), 664 pp.

C. A., 44, 3410i (1950).

This includes a chapter on emission spectroscopy (see abstract under Sherman, J. (1950)).

3320. BERTRAND, G. AND BERTRAND, D.

Rubidium and Other Alkali Metals in the Blood.

Bull. acad. natl. med., 134, 366-9 (1950).

C. A., 45, 1668f (1951).

Rb is a normal constituent of blood, amounting to an av. of 3.15 mg. per 100 cc. in the male and 2.83 in the female. Variations at the rate 1:3 occur.

3321. BERTRAND, G. AND BERTRAND, D.

Distribution of Rubidium in the Families of Phanerogams.

Compt. rend., 230, 343-5 (1950).

C. A., 44, 5431c (1950).

Rb analyses were made on 430 plant samples collected at various points in France. They represented 366 plant species and more than 16 families. Conclusions drawn from previous work are further substantiated, showing that among species of the same family the Rb content is fairly const. but that the averages for different families may vary widely. The revised average amts. of Rb in ppm. for the various families studied are as follows: dicotyledons 18.2; including Ranunculaceae 17.8, Cruciferae 23.4, Caryophyllaceae 27.3, Leguminosae 16.5, Rosaceae 11.7, Umbelliferae 18.8, Compositae 21.1, Boraginaceae 18.8, Solanaceae 27.9, Scrophulariaceae 11.8, Labiatae 11.0, Salsolaceae 37.6, Polygonaceae 21.8, and other families of this subclass 15.1; monocotyledons 15.8; including Graminae 12.5, and other families of this subclass 20.1. The av. for all phanerogams studied was 17.9 ppm. of Rb. The families Labiatae and Scrophulariaceae, which are similar morphologically, are similar in Rb content. This is further indication of the relation that exists among plants with respect to their morphology, physiol., and elementary chem. constitution.

3322. BERTRAND, G. AND BERTRAND, D.

Effect of Amount of Water on the Rubidium Content of Phanerogams.

Compt. rend., 230, 598-600 (1950).

C. A., 44, 6491g (1950).

Species of 12 families were analyzed for Rb. The species growing in water or wet places contained from 3 to 7 times as much as the species in the same family growing in dry places. The range for all species was 2.1 mg./kg. dry matter in *Teucrium chaemae-drys* to 74.8 in *Heracleum* sp.

3323. BERTRAND, G. AND BERTRAND, D.

The Rubidium and Alkali Metal Content of Plants Grown in Water and Air Culture.

Compt. rend., 230, 1553-6 (1950).

C. A., 44, 7939i (1950).

The Rb, Na, and K content of stems and roots of *Veronica anagallis*, *Oenanthe phellandrium*, and *Lysimachia nummularia* plants grown in water culture was compared with the same varieties when grown in air culture. In nearly all cases the content of these organs was higher when the plants were grown in water culture, and more cell substance was produced when this method of culture was used.

3324. BERTRAND, G. AND BERTRAND, D.
Rubidium in Relation to Potassium and Sodium in Human Blood.
Compd. rend., 230, 1815-17 (1950).
C. A., 44, 8472g (1950).
Mean values for Rb (mg./l.), K (g./l.), and Na (g./l.) as detd. spectrographically, were 3.15, 1.75, and 1.84, resp., for 10 men, and 2.83, 1.55, and 2.28, resp., for 9 women. Relative variations were greater for Rb than for K and Na. Levels of the 3 elements appeared to vary independently.
3325. BIFFEN, F. M.
Sodium and Potassium Determination in Refractory Materials Using Flame Photometer.
Anal. Chem., 22, 1014-17 (1950).
C. A., 44, 11051d (1950).
0.5 g. finely powd. sample is fused with 4.0 g. pure CaCO_3 and 0.5 g. NH_4Cl . The melt is leached, filtered into a 250-ml. volumetric flask, and neutralized with a few drops of HCl . If an internal Li standard is used, 100 ppm. of the nitrate is added and soln. is made to vol. CaO content should range between 1500 and 1800 ppm. The flame method was tested upon Celite, Sil-O-Cel, plastic clay, opal and borosilicate glasses, and firebrick. (CaO in the 250-ml ext. solns. of these was within the above range.) Standard curves are prepd. over appropriate ranges with approx. the same quantity of CaO . A Perkin-Elmer Model 52A instrument was used either with or without an internal Li standard. Results check well with longer gravimetric methods and are probably more accurate for samples contg. much K and little Na.
3326. BLACK, I. A. AND SMITH, E.
Routine Determination of Exchangeable Bases in Soils by the Lundegårdh Flame Spectrographic Method.
J. Sci. Food Agr., 1, 201-8 (1950).
C. A., 45, 795i (1951).
A modified procedure for detg. exchangeable bases which also gives information on the base satn. of the soil. The modifications include an automatic leaching app. for extg. soils with NH_4OAc ; the use of aqua regia for destroying org. matter; a combination of new dilns. and standards with the use of a metol developer which extends the range of soils; a modified plate holder which enables 88 spectrograms to be recorded on a 5×4 -in. plate; and a method of plotting working curves from photometric data.
3327. BLAND, J. AND GOLDSPIEL, S.
New Procedures for Studying Electrode Coverings.
Welding J. (N. Y.), 29, 522s-9s (1950).
C. A., 45, 4174i (1951).
An X-ray spectrometer method for rapid classification of welding electrode coverings into types, an X-ray spectrometer method for detg. crystal forms and amts. of TiO_2 and SiO_2 , an optical emission spectrographic method for the detn. of metallic elements, and a loss in wt. method for following moisture changes are described and discussed.
3328. BOGDANOVA, V. V.
Spectroscopic Determination of Cerium in Magnesium Alloys.
Zavodskaya Lab., 16, 1406 (1950).
C. A., 45, 10124g (1951).
The best lines for the spark method are Ce 3171 and O 3377 Å. A carbon cone forms the other electrode. Constancy of spectrum is reached in 20 sec. The results agree within 5%. Detn. of Mn in Mg alloys is possible with the Mn lines of Mn 3033.6 and Mg 3074.1 Å.
3329. BONATTI, S.
Thorite of Nettuno (Italy).
Atti soc. toscana sci. nat. (Pisa), Mem., Ser. A, 57, 182-3 (1950).
C. A., 46, 3912b (1952).
Crystals of 0.2 mm. contained in sands at Nettuno gave an ultraviolet spectrogram close to that of the thorite of Brevig, Norway, except that the line for U was less intense and that for Be was absent in Nettuno crystals. Crystallographical data: tetragonal bipyramid with forms {110}, {111}; (110) (111) = $48^\circ 29'$; $a:c = 1:0.626$; space group D_{2h}^{16} ; structure type H_2 , a_0 7.03 Å, $c_0 = 6.25$ Å. Optical data are given.
3330. BOROVIK, S. A.
Determination of Sulfur, Selenium, and Halogens in Ores and Minerals by Spectral Analysis. Method of Spectral Analysis of Solutions.
Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., 14, 630-3 (1950).
See Borovik 1949.
3331. BOROVIK, S. A. AND BOROVIK-ROMANOVA, T. F.
The Use of a High-Frequency Tesla Generator for the Quantitative Spectral Analysis of Solutions.
Doklady Akad. Nauk S.S.S.R., 73, 683-4 (1950).
C. A., 45, 3733i (1951).
The electrode employed is similar to that described previously, except that the soln. is drawn into the slot through an axial canal. See also Treadwell and Walti (*C. A.*, 35, 1339^b) and Nedler and Efendiev (*Zavodskaya Lab.*, 10, 198-9 (1941)).

3332. BOROVIK, S. A. AND BOROVIK-ROMANOVA, T. F.

Some Applications of Spectral Analysis in Geochemistry.

Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., 14, 665-9 (1950).

C. A., 45, 6954i (1951).

(1) H₂O solns. contg. small quantities of Li, Rb, and Cs were evapd. in a trough made in the lower C electrode and analyzed in an a.-c. or d.-c. arc of 220 v. and 10 amp. with plates sensitized for red-infrared, on lines Li 6707.844, Cs 8521.10, Rb 7800.225 Å. Large amts. of NaCl exercise a considerable influence on the working curves. (2) Very high sensitivity can be obtained with a 2 amp./3000 v. arc, the parameters of which are given. The C electrode in the "fulgurator" is placed in a small container, the bottom of which is filled with soln. This soln. is raised by capillary action through a cut in the C electrode to a small trough cut in at the top. Solns. can also be analyzed in the fulgurator with a high-frequency generator having a triple spark gap. Control expts. were made with Sr line 4077.71 compared to the line Zr 3991.13 Å.

3333. BORISOV, V. P., GRAMM, O. S., RIMLYAND, S. S., SVENITSKIĬ, N. S., AND TAGANOV, K. I.

Spectral Determination of Carbon in Steels and Cast Iron.

Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., 14, 611-17 (1950).

C. A., 45, 6965a (1951).

The spectral line C III 2296.86 Å is selected for analysis. This line is best obtained with a "high-frequency spark of low power," which is generated in a circuit contg. a 3000-v. 50-100 VA transformer, a capacitor of 0.02 microfarad, and a choke of 10 microhenry. In this setup the intensity of the C lines is similar to the intensity in the a.-c. arc, there is no background and the spark penetrates in steel to a depth of 0.05 mm. and even less (to a few μ if the object is moved) permitting local analysis of samples. Since the surface of steel and cast Fe is poorer in C than the interior, at least 3 mm. of the original surface must be polished off in standards. Working curves are given for the line pair C 2296.86-Fe 2298.18. If the samples contain more than 1% Ni intensity of the lines Ni 2297.14 and 2296.55 must be compensated for by prior detn. of Ni content. In cast iron with a Feussner spark it is possible to det. Cr, Mn, and Si simultaneously with C.

3334. BORZOV, V. P. AND SVENITSKIĬ, N. S.
Spectroscopic Analysis of Aluminum Alloys with Spectrum Excitation by an Alternating Current Arc.

Zavodskaya Lab., 16, 1509-11 (1950).

C. A., 45, 10133e (1951).

The arc generator was modified by inclusion of an induction coil to aid the maintenance of a steady arc at low-current levels (1-2 amp.) and the standard reference electrode was a Cu cone-shaped rod. For detns. the following lines are suggested: Si, Si 2987.65- Al 3050.08 (1.4% error), or Si 2514.3- Al 2652.49 (1.6% error); Fe, Fe 2973.2- Al 3050.08 (2.5% error) or Fe 2973.2- Al 3050.08 (1.4% error); Zn, Zn 3345.0- Al 3050.08 (3.3% error); Mg, Mg 3332.2- Al 3050.08 (0.8%); and Mn, Mn 2933.1- Al 3050.08 (0.9% error).

3335. BRECKPOT, R.

A New Direct-reading Electronic Spectrometer. Application to the Analysis of Carbon and of Phosphorus in Steel.

Mém. centre natl. recherches mét., Sect. Hainaut, Dec., 1950, 11-18.

C. A., 45, 7382h (1951).

An instrument with photoelec. multiplier tubes is described. The intensity of the 2136.19 Å line of P was measured with an IP28 multiplier tube. A reproducibility of the order of $\pm 2\%$ was obtained for samples contg. 0.01-0.3% P. Care must be exercised to avoid interference from the 2135.98 Å line of Cu. No interference from Cu was noted with Cu concns. up to 0.1%. Conditions of the expt. were: electrodes (samples cut from specimens to be analyzed finished on the end with a 60° angle and a flat 1.5-2 mm. in diam.); current (3 amp.); slit width (20-30 μ). The intensity of the C III 2296.86 line of C was used in analysis. Care must be taken to avoid interference from neighboring lines of Ni. The intensity of interfering Fe lines can be assumed to be const. in all samples. Ag was recommended as the 2nd electrode. The intensity of the C III 2296.86 line decreased rapidly during the first 15-30 sec. and then achieved a const. value. Max. intensity could be obtained by slowly moving the specimen electrode so that a fresh surface was continuously exposed. C in the range of 0.025 to 1% can be analyzed by this method with a mean error of approx. 1%.

3336. BRECKPOT, R.

Direct Analysis and Analysis of Gases.

Résumé en Rev. Univ. Mines, 6, 73-4 (1950).
Spectrochim. Acta, 4, 416 (1951).

A quartz-prism spectrograph of moderate dispersion is combined with an electronic system which integrates light received by phototubes to permit direct detn. of phosphorus and manganese in steels, zinc in cadmium, and antimony in zinc. For the detn. of P the line at 2136.2 Å is used. The spectra are excited by employing various discharges of continuous or intermittent arc type powered by diverse generators, but for P

these different sources all give the same result with an error of 2 to 3%. The detn. of N, S and C is envisaged.

3337. BRECKPOT, R. AND CLIPPELIER, M. DE

The Electronic Multispectrometer. Application to Determination of Carbon in Steel.

Congr. groupe. avance. méthod. anal. spectrograph. produits mét., 13, 51-9 (1950).

A spectrometer with four electron multiplier phototubes is described. Three features of this instrument are automatic operation, immediate reading of results, and localization and rapid repair of defects in electronic circuits. An application of this spectrometer to the detn. of carbon in steel is made by observing the C III line at 2296.86 Å when the spectrum of the sample is excited by a high-voltage condensed spark. Carbon content from 0.025 to 1% has been studied. The standard deviation is about $\pm 1\%$. From experiments it was concluded that the CO₂ in ambient air, and its small fluctuations due to the breathing of operators, do not affect the measurements.

3338. BRECKPOT, R. AND GOBERT, C.

Spectrophotometric Determination of Carbon in Steel.

Bull. soc. chim. Belges, 59, 102-6 (1950).

C. A., 44, 8822i (1950).

C was rapidly detd. from the C III 2296.86 Å line. Details of the app. which included photomultiplier tubes and opposing electrodes of Ag or Al are given.

3339. BRETÓN, A. S.

Technique in Using the Carbon Electrode as Reference Element in the Spectroanalysis of Solutions. I, II.

Anales real soc. españ. fís y quím., 46A, 283-92, 293-304 (1950).

C. A., 45, 4599a (1951).

Sparking solutions in C electrode holders resulted in using a C line for reference. The best line was 2478.6 Å. A technique was developed which compared with a recognized method of spectroanalysis of solns. and gave acceptable errors. Detns. were made of various solns. contg. Mn, Pb, Zn, and Ni in various concns.

3340. BREWSTER, D. A. AND CLAUSEN, C. J., JR.

Sodium Content in Aluminum Speedily Analyzed.

Iron Age, 166, No. 18, 88-92 (1950).

C. A., 45, 493e (1951).

A rapid photometric method for detg. Na in Al and its alloys is described. Light

intensities of atomized solns. are measured with a Beckman flame spectrophotometer. The flame unit consists essentially of an atomizer, spray chamber, burner, and control unit. The fuel mixt. used in the burner consists of air, C₂H₂, and O. Methods of prep. standards and details of manipulation are described. The concns. of the alloying elements normally found in Al alloys have no apparent effect on the analytical data. A test run on 9 samples contg. 0.017% Na and 8 samples contg. 0.0012% Na proved the precision of the method to be exceptionally good with an av. deviation of only 0.0004% of the wt. of the sample. The results agreed well with those obtained by the triple acetate procedure. The procedure is applicable over the range of 0.001 to 0.050% Na.

3341. BRITISH IRON AND STEEL RESEARCH ASSOCIATION (Spectrographic Analysis Sub-Committee)

Contribution of the Source Unit to Variability in Spectrographic Analysis.

J. Iron Steel Inst., 166, 325-8 (1950).

Spectrochim. Acta, 4, 414 (1951).

A comprehensive statistical study of errors in ferrous analysis by means of photographed spectra has confirmed that about 20 to 50% of the total error can be traced to the contribution of the source. Tests were made on a steel containing 0.28% C, 0.29% Si, 0.53% Mn, 0.013% S, 0.015% P, 0.83% Cr, 2.74% Ni and 0.49% Mo, using the following types of excitation sources: Dietert Multisource, Feussner controlled spark, Hilger (uncontrolled) condensed spark, B.N.F. General-Purpose unit and various experimental modifications. No very significant differences were indicated in the performance of any of the sources under the conditions of test. Possibilities of improved source performance are considered.

3342. BRIT. STANDARDS INST.

Terms Used in Spectrographic Analysis. I.

Emission Spectrography.

Brit. Standards Inst., London, S.W. 1.

Brit. Standard 1636 (1950), Pt. 1, 10 pp.

C. A., 44, 5259e (1950).

The terms used in photographic photometry are defined.

3342a. BRITSKIE, M. E., VARSHAVSKAYA, L. N., AND IVANTSOV, L. M.

Spectral Analysis of Metallic Zinc.

Zavodskaya Lab., 16, 1207-14 (1950).

C. A., 47, 3180f (1953).

Detns. were made with Cu 3247.5 and Zn 3075.9; Cd 3403.6, 2288.0, and Zn 2712.5; Fe 3581.2 and Zn 3075.8; Pb 2833.1, and Zn 2712.5; Sb 2528.5 and Zn 2712.5. The tests were with a quartz spectrograph, with an a.-c. arc as source of light.

3343. BRODE, W. R.
Chemical Spectroscopy.
Proc. Am. Soc. Testing Materials, 50, 513-59 (1950).
C. A., 46, 4903d (1952).
An address reviewing the fields of emission and absorption spectroscopy, with 60 illustrations and 61 references.
3344. BROWN, J. G., LILLELAND, O., AND JACKSON, R. K.
Use of Flame Methods for the Analysis of Plant Material for Potassium, Calcium, Magnesium, and Sodium.
Proc. Am. Soc. Hort. Sci., 56, 12-22 (1950).
C. A., 46, 1391a (1952).
Details of the procedure are given.
3345. BRUCELE, G.
Establishment of a Method for the Spectrographic Determination of Carbon in Steel.
Congr. groupe. avance. method. anal. spectrograph. produits mét., 13, 43-7 (1950).
Carbon, generally constituting from a few tenths to one percent of steel, is determined by spark excitation of the sample opposite a counter electrode of zinc, photographing the spectrum with a Zeiss Q 24 spectrograph and measuring the intensity ratio of Fe III 2295.8 Å and C III 2296.8 Å radiations with a photoelectric photometer. The calibration is derived from standard samples.
3346. BURAVLEV, Y. M.
Influence of the Structure on the Spectral Analysis of Composite Alloyed Steels.
Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., 14, 579-83 (1950).
C. A., 45, 6955d (1951).
Seven representative steel samples contg. C, Mn, Si, Cr, Ni, Cu, Mo, W, and Co were spectrographically analyzed. Each sample after rolling was cut into 2 parts, one of which was annealed at 1100-1300° and quenched in liquid N₂ to give a metastable structure. At ordinary spark strength (secondary voltage 12,000, capacity ≥ 0.004 microfarad, inductance 0.08 millihenry) there were no differences in the detn. of the above 8 elements in both parts; at lower spark strength, however, differences due to surface structure could be observed.
3347. BURRIEL MARTI, F. AND RAMÍREZ-MUÑOZ, J.
Spectrographic Analytical Determination of Bismuth in Its Alloys after a Preliminary Concentration.
Anal. Chim. Acta, 4, 428-36 (1950) (in English).
C. A., 44, 10577f (1950).
The quant. spectrographic detn. of Bi in its alloys contg. Pb and other elements in varying concns., after a preliminary selective sepn. and concn. of the Bi by means of cupferron, is described. A medium dispersion Fery-type (Littrow system) quartz spectrograph was used in the work. The Bi concentrate was applied to the arc in the form of a solid sulfate. Zn was used as an internal standard, and a method for the detn. of the Pb content in the samples was also indicated.
3348. BUYANOV, N. V.
Spectral Analysis of Small Quantities of Lead and Antimony in Nickel Alloys.
Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., 14, 649-52 (1950).
C. A., 45, 6961e (1951).
Small concns. of Pb (0.0005-0.02%) and Sb (0.0015-0.15%) were detd. in an a.-c. arc. The selected line pairs were Pb 2833.07/Cr 2840.02; Pb 2833.07/Fe 2831.56; and Sb 2598.06/Cr 2603.51; working curves are indicated and it is shown that an upper electrode of Cu increases the intensity of the Sb line and decreases the intensity of the Pb line as compared to an Al electrode.
3349. CARLSSON, C. G. AND YÜ, J. T. M.
Spectrochemical Analysis of Steelmaking Slags.
J. Iron Steel Inst. (London), 166, 273-80 (1950).
C. A., 45, 5054d (1951).
The briquetted mixt. of the slag sample with graphite powder is excited by a low-tension, arc-like triggered spark. The percentages of various oxides are calcd. by using a mutual standard method. The standard deviation of repeat detns. of lime-silica ratio is from 0.036 to 0.083 in slags from 1 to 3.8 lime silica ratio. The detn. of SiO₂, CaO, FeO, MnO, MgO, and Al₂O₃ agrees well with the results of routine chem. analysis. The time required is about ½ hour.
3350. CARLSON, M. T. AND GUNN, E. L.
Determination of Trace Metallic Components in Petroleum Oils by Means of the (Emission) Spectrograph.
Anal. Chem., 22, 1118-21 (1950).
C. A., 45, 1755d (1951).
Fe, Ca, Ni, Cr, V, Al, Si, and Na (2-100 ppm.) are detd. directly in oil-feed stocks. A measured quantity of a blend of Co and Li oleates is mixed with the sample and absorbed in a definite manner on a hot C electrode. The cathode layer principle is used for increased sensitivity. Standards are prepd. similarly from base stocks (percolated mineral oil, hexadecane, oleic acid) plus various trace quantities of the above metals as acetates, stearates, vanadate, silicone, or NaOH. Analytical line pairs are listed with internal standard lines as follows: Li for Na and Ca, Co for the others.

3351. CAROBBI, G.
Small Quantities of Mercury in Some Celestites and Strontianites.
Atti soc. toscana sci. nat. (Pisa), Mem. 57, Ser. A, 32-7 (1950).
C. A., 45, 10149h (1951).
The Ba, Ca, Pb, B, Si, Al, Fe, Mg, Mn, and Na contents of 3 German and English strontianites and 13 Italian, American, French, and English celestites were spectrographically (arc spectrum) estd. and tabulated. Cs, Co, Sn, Ge, and As were always absent. Hg, detd. colorimetrically by the dithizone method (cf. *Barnes, C. A.*, 44, 10343b) and spectrographically as electrodeposited metal on Al electrodes, was 0.001-0.003% in 2 of 3 strontianites and 0.0001-0.003% in 8 of 13 celestites.
3352. CARRIGAN, R. A. AND ERWIN, T. C.
Cobalt Determination in Soils by Spectrographic Analysis Following Chemical Preconcentration.
Soil Sci. Soc. Am., Proc. 15, 145-9 (1950).
C. A., 46, 204d (1952).
Analyses were made for Co in sandy soils, following HF attack, and in exts. prepd. with NH_4OAc , AcOH , and HCl . The Co was concd. from the soil ext. by solvent extn. with dithizone in CCl_4 soln. The analysis was completed by conventional arc spectrography. As little as 0.1% of Co can be detd.
3353. CASTRO, R.
Principles and Choice of Spectrochemical Analytical Methods.
Rev. mét., 47, 521-7 (1950).
C. A., 44, 9296i (1950).
A review.
3354. CAVANNA, D. AND ANGELERI, C.
Spectrographic Determination of Lead in Blood.
Boll. chim. farm., 89, 213-19 (1950).
C. A., 44, 8988a (1950).
Mix 3 cc. blood with a soln. of 5% Mo as NH_4 salt, evap., and incinerate at 420° for 1 hr. Add a drop of H_2O and spark it between 2 pure C electrodes. Mo has a line at 2816 Å which serves as a standard for the line of Pb at 2833 Å.
3355. CHERNOBROV, S. M. AND SHEVARTS, D. M.
Spectroscopic Determination of Admixture of Nickel in Cobalt.
Zavodskaya Lab., 16, 1505-6 (1950).
C. A., 45, 10128a (1951).
Detn. with av. absolute error of 8% in the range 0.09-0.11% Ni can be made by using line pairs Ni 3002-Co 2996.5 and Ni 3134-Co 3145. The usually low levels of Fe and Cu do not interfere.
3356. CHESNIN, L. AND JOHNSON, W. C.
Application of Centrifugal Force to Obtain a Saturation Extract of Soil Suitable for Flame Photometric Analysis.
Soil Sci., 69, 497-8 (1950).
C. A., 44, 10979c (1950).
Suitable exts. were obtained by moderate to high-speed centrifugation followed by filtration. An av. of 29.5% of the water used to prep. soil pastes was recovered in a suitable form for analysis.
3357. CHURCH, F. L.
The Analytical Quantometer.
Modern Metals, 6, No. 2, 23-4 (1950).
C. A., 45, 5460h (1951).
The quantometer is an improved spectrograph which permits faster and more accurate operation by eliminating the photographing of the spectrum. In the time it takes to make 7 spectrometric detns. 42 detns. could be made with the new instrument, which proved particularly useful in analyzing Al scrap.
3358. CIORNAI, I.
Some Applications of Flame Photometry.
Anais assoc. quim. Brasil, 9, 34-9 (1950).
C. A., 45, 10065b (1951).
A discussion of the use of a photometer in detns. by measuring the characteristic radiation of an element at high temps., the intensity of which is a characteristic of the concn. of the element.
3359. CLAFFY, E. W. AND SCHUMACHER, J. G.
An Improved Electrode Cutter for Spectrographic Laboratories.
Rev. Sci. Instr., 21, 575 (1950).
Spectrochim. Acta, 4, 259 (1950).
The authors experienced difficulties with the Applied Research Laboratories electrode cutter and saw, No. 2380, in that this equipment would not cut nor shape uniformly from $\frac{1}{4}$ in. electrode rods whose diameter varied as is normal with commercial rods. By modifying the equipment to take a new cutter and holder, it is claimed now possible to cut craters of 3 mm. diameter and depth with very unusual uniformity.
3360. CLIPPELEIR, K. DE
Automatic Microspectrochemical Analysis.
Mededel. Vlaam. Chem. Ver., 12, 71-5 (1950).
C. A., 44, 10571e (1950).
A survey of the construction and use of quantometers for especially rapid detn. of trace impurities in metals.
3361. COHBUR, P.
Equipment Used in Spectral Analysis.

- Rev. mét.*, **47**, 531-43 (1950).
C. A., **44**, 9194c (1950).
 Com. equipment, mostly of U.S. origin, but some French and British, is described.
- 3362. COJAN, M.**
 Spectrographs of High Light Intensity.
Congr. groupe. avance. method. anal. spectrograph produits mét., **13**, 81-7 (1950).
 A discussion of the design of prism spectrographs of high light intensity, particularly for Raman spectroscopy, the spectra of aurora borealis, and other faint light sources. Instruments with lens aperture to focal length ratios of 0.65 have been constructed.
- 3363. CONRAD, A. L. AND JOHNSON, W. C.**
 Flame Photometer Techniques for Determining Typical Additives in Petroleum Oils.
Anal. Chem., **22**, 1530-3 (1950).
C. A., **45**, 3153f (1951).
 Petroleum base oils contg. additives are analyzed for Ca, Ba, K, and Li without wet-ashing. The sample is dissolved in a 50-50 mixt. of benzene and iso-PrOH in the approx. ratio of 2.5 g. oil per 100 ml. of solvent. Metal naphthenates, chemically analyzed, are used for the prepn. of standard solns. The blanks which are run to correct for the spectrum background contain the same concn. of additive-free oil. Δ -Emission values are proportional to concns. of cations when the quantity of additive-free oil in the blank is within 20% of the quantity of the unknown oil referred to the same vol. of solvent. Viscosity effects enter and destroy the linear relation between Δ -emission and element concn. if the sample/solvent ratio is not fixed. Av. deviations are slightly over 1% for Ca, Ba, and K in naphthenate blends and additive oils, and about 5% for Li in additive oils. Anion interferences are negligible for Ca and K in concns. of the order of 4-7 ppm. Cation interference ratios are given for elements expected in lubricating oil additives.
- 3364. CONVEY, J.**
 Spectrograph as a Research Tool in Metallurgy.
Chemistry in Can., **2**, No. 3, 23-6 (1950).
C. A., **44**, 5773i (1950).
Cf. J. Iron Steel Inst. (London), **152**, 11, 473 (1945); *C. A.*, **39**, 3757^a.
 To study the variations in compn., a highly localized condensed spark is made to traverse the sample (1 mm./min.) while the photographic plate upon which the spectrum is recorded is moved downwards across the camera aperture of the spectrograph (10 mm./min.). Marked variations are found to exist within a segregate. This method is ideally suited for studies in metallic diffusion, e.g. in welded structures.
- 3365. CORLISS, C. H., ET AL.**
 Report on Standard Samples for Spectrochemical Analysis, 1950.
 American Society for Testing Materials, *Tech. Pub.* 58B (1950), 31 pp.
 Reviewed in *Spectrochim. Acta*, **4**, 426 (1951) by E. van Someren: "This admirable handbook replaces earlier editions published by the same Sub-Committee of the A.S.T.M. to provide in convenient form, current information on spectrochemical standard samples. The need for the revision is brought out by the fact that this booklet lists over a thousand standard samples and pure substances, while the previous edition only listed under 600. For each standard sample the chemical composition is given, also the form of the sample, whether solid rod or plate or turnings or powder, and in some cases the method of analysis in which it is intended to be used. The suppliers are also listed; there are 43 suppliers of specially pure materials in the list, of which 42 are American and one British. From this one might conclude that it is time that European spectroscopists organized the compilation of a similar list, even more complete in its scope. The relative abundance of standards for different metals reflects the extent to which spectrochemical analysis is applied to each metal; and of the alloys listed over half are of aluminum. In some of these alloys ten or a dozen minor constituents have been checked; and many alloys are sold in sets corresponding to the average and limiting compositions of a commercial material. The list of pure materials reveals the gaps in the effort to prepare pure substances, and hence also the difficulties. It may surprise readers to find that only nine elements are listed with a purity of 99-999% or more. On the other hand, spectroscopists will realise that it is largely owing to spectroscopy that many elements which were sold as "Chemically Pure" thirty years ago are now known to be fairly complicated mixtures; the search for purity has turned out to be a method of discovering impurities."
- 3366. CORRÊA DE SÁ, Y. M.**
 Spectrographic Determination of Molybdenum in Steel.
Anais assoc. quim. Brasil, **9**, 59-60 (1950).
C. A., **46**, 376h (1952).
 The results are given of detns. of Mo in steel, based on the microphotometric comparison of a const. trace of Fe (2823.28 Å) of mean intensity with the trace of Mo (2816.15 Å), the intensity of which depends on the concn.
- 3366a. CREMASCOLI, F.**
 Germanium and Its Spectrographic Determination in [Italian] Zinc Ores.

Ind. mineralia, 1, 83-6 (1950).

C. A., 47, 4256b (1953).

Spectrographic detns. of Ge in sphalerites of Montevecchio, Tarvisio, Presolana, Gorno, Campo Pisano, and Vipiteno (all "floated" samples) and in hemimorphites of Agruxiau, San Benedetto, and Gorno gave 0.0115, 0.006, 0.000566, 0.00166, 0.00151, absent, 0.001, 0.00125, and 0.0004%, resp. (Zn content 60.2, 58.0, 63.0, 58.8, 45.0, 52.4, 35.5, 37.85, and 52.0%, resp.).

3367. CROSSWHITE, H. M.

Photoelectric Intensity Measurements in the Iron Arc.

Spectrochim. Acta., 4, 122-51 (1950).

C. A., 44, 10500a (1950).

Techniques are described which permit the measurement of spectral intensities in general to within less than 1%, by using multiplier phototubes and a recently developed electronic pen-and-ink ratio recorder. The phototubes are linear, and with a tungsten-lamp sensitivity calibration accurate intensity measurement over wide wave-length intervals are now possible. The recorder measures the intensity ratio from two phototubes, so that a fixed tube may serve as a monitor for one which scans the spectrum, in this way canceling out intensity fluctuations of the source. In this manner direct quant. studies of light-source properties are possible. As a particular application, relative intensities of over 1000 lines from a standard d.c. iron arc were measured. Quant. data are also given for self-absorption and the variation of the intensities with excitation conditions. The iron arc can be used as an intensity standard for many applications.

3368. DAVIS, H. M. AND WEBB, R. J.

The Application of the Cathode-ray Tube to Microphotometry of Trace Elements.

Spectrochim. Acta, 4, 13-20 (1950).

C. A., 44, 7150e (1950).

The app. described is designed as an accessory to a nonrecording microphotometer for presenting a picture of the blackening contour of a portion of a spectrogram on the screen of a cathode-ray tube. Although of general application, its principal function is the detection and estn. of trace elements in complex spectra, when normal nonrecording microphotometry and visual methods are difficult or impractical. A method for the quant. interpretation of the contours and particular implications of this aspect of microphotometry are discussed.

3369. DICK, J. AND PUGSLEY, L. I.

The Arsenic, Lead, Tin, Copper, and Iron Content of Canned Clams, Oysters, Crabs, Lobsters, and Shrimps.

Canad. J. Res., 28(F), 199-201 (1950).

Spectrochim. Acta, 4, 314 (1951).

The lead, tin, copper, and iron contents of the samples were detd. spectrographically by a modification of Cholak and Story's method (1938) using bismuth as the internal standard.

3370. DILANYAN, A. M. AND TER-MARKOSYAN, S. K.

Spectrum Analysis of Various Cultures of *Saccharomyces ellipsoideus*.

Doklady Akad. Nauk Armyan. S.S.R., 12, No. 2, 57-63 (1950).

C. A., 46, 10530g (1952).

Spectrographic detns. of Al, Ca, Cu, Fe, K, Mg, Mn, Na, P, Pb, Si, Sn, and Ti were made on various strains of *Saccharomyces ellipsoideus* from 1945 to 1947, and 1948 cultures. Strain No. 47 showed presence of Ti in the course of active fermentation during wine prepn., while active strains No. 28, 46, 47 during wine formation showed the presence of Pb, Sn, Mn, and Na. Unusually high K levels were detected in 1945 cultures. Much P is found in the yeast cells (spectrometrically) during fermentation; P is absent in the anabiosis stage of yeast and during formation of certain varieties of wines.

3371. DINGLE, H.

Practical Applications of Spectrum Analysis.

London: Chapman & Hall (1950), 250 pp.

The book is devoted largely to the physical background of spectroscopy including theory of spectra, prism and grating spectrographs, measurement of wavelengths, and the detection of the individual elements. Modern excitation sources and methods of spectrochemical analysis are not treated. Tables consist of the iron spectrum (Burns 1913) and tables of sensitive lines.

3372. DOORSELAER, M. VAN

Quantitative Spectrochemical Analysis of Ancient Bronzes.

Verhandel. Koninkl. Vlaam. Acad. Wetenschap., Klasse Wetenschap., 12, No. 35, 3-27 (1950).

C. A., 45, 2367b (1951).

Dissolve 4 mg. of sample in $\text{HNO}_3 + \text{HCl}$; allow the soln. to be absorbed in a pure graphite electrode at 80° and evap. to dryness. For Cu, Sn, and Pb obtain the condensed-spark spectrum of a soln. contg. 1% of bronze and 2% of added Cu and compare the intensities of the line pairs Sn 2429.5/Cu 2441.6 and Pb 2833.07/Cu 2882.9. From the results, by means of standard curves, the content of all 3 metals can be detd. with a precision of approx. 3%. For the minor and trace elements, obtain the Pfeil-

sticker interrupted-arc spectrum of a 3% soln. of the bronze and compare the intensities of the lines Ni 3050.8/Cu 3073.8, Fe 2488.15/Cu 2400.1, Zn 3345.6/Cu 3349.3, As 2349.8/Cu 2400.1, Sb 2877.9/Cu 2882.9, Co/2407.26/Cu 2400.1, Au 2428.0/Cu 2400.1, Bi 3067.73/Cu 3073.80, Ag 3382.9/Cu 3349.26. Other line pairs are recommended for special situations. For these elements the precision is approx. 10%. Analyses of various bronze artifacts are included. The methods are also applicable to a variety of tech. Cu alloys.

3373. DRUTSKAYA, L. V.

Determination of Zinc in Aluminum by Spectrography.

Zavodskaya Lab., 16, 495 (1950).

C. A., 44, 10589d (1950)

Detn. of Zn to 0.005% is possible by using conventional a.-c. arc with current interrupter (3 times/sec.), with 3-3.5 amp. being passed through the 1.5-mm. arc gap. The line used for comparison with the standard is the 3059.92 Å Al line with the 3345.0 Å line of Zn; at low concns. (under 0.01%) the "air" line 3344.8 Å may lead to somewhat high results when the spark method is used, while the arc method is not affected.

3374. DUNKER, E. AND PASSOW, H.

Increasing the Accuracy of Analysis by Flame Photometry.

Biochem. Z., 321, 152-7 (1950).

C. A., 45, 3281d (1951).

A stable flame can be secured by high gas pressure and extremely fine spraying of the soln. Since the latter is largely dependent upon the surface tension, it is essential that both the standard and unknown solns. should have the same physiochem. properties. The flame light should be thoroughly filtered to exclude light emitted by ions other than the ion investigated, and the responsiveness of the photoelec. mechanism must be adjusted to the filtered light. It is recommended that null compensation should be employed with photocells and the parts should be guarded against being heated by the flame.

3375. DWYER, R. J.

A Variable Frequency Electronic Interrupter for the Direct Current Arc.

J. Opt. Soc. Am., 40, 180 (1950).

A note concerning a thyatron tube circuit to provide an intermittent d.-c. arc of selected frequency.

3376. EHRLIN-TAMM, G.

Some Improvements in Flame Photometric Determination of Potassium.

Acta Chem. Scand., 4, 1317-19 (1950) (in English).

C. A., 46, 6992i (1952).

To avoid errors resulting from the non-linear brightness vs. concn. curves obtained with hotter flames, the log of K^+ concn. can be plotted against log of galvanometer reading to give a linear plot in the range from 0.5 to 40 mg./l. of K. Effects of continuous drifts in gas or air pressure are compensated by repeating a series of measurements in the reverse order.

3376a. ELENBAAS, W. AND RIEMENS, J.

Light Sources for Line Spectra.

Phillips' Tech. Rundschau, 11, 304-7 (1950).

Chem. Zentr., 1950, II, 797.

C. A., 47, 7315f (1953).

The construction and operation of Phillips' Spectral lamps are described. The oxide cathodes require no preheating, as they are sufficiently heated by the discharge. Spectra in the visible and ultraviolet are reported for Hg (both high and low pressure), Cd, Zn, He, Ne, A, Kr, X, Na, Rb, and Cs. Data are given regarding lamps and suitable filter combinations for the production of monochromatic light.

3377. EMIDIO BARBOSA, P.

Increasing the Precision of Quantitative Spectrographic Analyses.

Anais assoc. quim. Brasil, 9, 40-6 (1950).

C. A., 46, 371f (1952).

To diminish errors due to nonhomogeneity of a substance whose concn. is measured by intensities in several regions of the curve, the method of the internal mean is recommended, in which the mean is taken of traces obtained from single exposures of a large no. of samples. If it is desired also to use the traditional method of the external mean, it is recommended that, in order to obtain the final mean, 4 exposures should be made of each of several samples.

3378. EMIDIO BARBOSA, P.

Conditions Governing Precision in Quantitative Spectrography.

Anais assoc. quim. Brasil, 9, 47-58 (1950).

C. A., 46, 371g (1952).

To obtain the best precision repeated measurements are recommended, as the variation of error is inversely proportional to the sq. root of the no. of observations.

3379. BYAROVICH, M. A.

Application of the Steeloscope to the Standardization of Pharmaceutical Products.

Izvest. Akad. Nauk U.S.S.R., Ser. Fiz., 14, 683-4 (1950).

C. A., 45, 7298h (1951).

Different pharmaceutical preps. are examd. in an activated arc. Cu and Zn can be detd. in BaSO_4 (for X-ray examn.) in concns. of 0.001%.

3380. FARHAN, F.
Spectrographic Determination of Gallium in Aluminum.
Mikrochemie ver. Mikrochim. Acta, 35, 565-8 (1950).
C. A., 46, 494d (1951).
A series of standard alloys of pure Al with known Ga content were prepd. and analyzed by the intermittent-arc method. As little as 0.01% Ga can be detd.
3381. FARMER, V. C.
The Spectrographic Analysis of Plant Ash in the Carbon Arc.
Spectrochim. Acta, 4, 224-8 (1950).
C. A., 45, 2368b (1951).
A spectrographic method with the cathode layer d.-c. arc technique for the detn. of Cu, Fe, Mn, Sr, Ba, Na, Mg, and Ca in plant ashes without chem. pre-treatment is described. One g. of oven-dry plant material is ashed overnight in an elec. muffle at 450°. Fifteen mg. of the ash are mixed in an agate mortar with 15 mg. K_2SO_4 and 30 mg. of C powder contg. 250 ppm. of Ag and 150 ppm. of Cr. The K_2SO_4 acts as a buffer to minimize variation in the Cu/Ag intensity ratio with different Ca content, Ag and Cr provide internal standards for the elements to be detd. The concns. of elements being detd. are obtained from curves prepd. from spectra of three sets of synthesized standards, one set contg. Sr, Ba, Mn, Fe, and Cu, the second contg. Mn and Na, and the third Ca. A method for prepg. $CaCO_3$ free from Sr and Ba is outlined.
3382. FASSEL, V. A. AND ANDERSON, C. H.
Quantitative Spectrographic Analysis of Zirconium-hafnium Mixture.
J. Optical Soc. Am., 40, 742-7 (1950).
C. A., 45, 496g (1951).
A spectrographic method for the analysis of Zr-Hf mixts. is described. The samples are excited as conducting pellets prepd. from mixts. of the combined oxides with powd. flake graphite. An overdamped condenser discharge is used for excitation. By utilizing a series of internal standard line pairs, the complete concn. range can be covered by a single exposure. At the same time, photographic errors can be reduced by restricting the intensity ratio range over which these line pairs are measured. The unique similarity in the phys. and chem. properties of Zr and Hf, together with the use of line pairs of similar excitation characteristics, provides a system by which ideal internal standard conditions can be obtained. Exptl. results indicate that, within the wide limits investigated, variations in excitation conditions, extraneous elements, graphite-oxide ratio in the pellets, crystal structure of the oxides, and chem. form of the samples, have no apparent effect. The results are mostly within 2% of the truth.
3383. FAST, E.
Spectrographic Determination of Potassium in Iron Catalysts by Fractional Distillation.
Anal. Chem., 22, 320-2 (1950).
C. A., 44, 5263g (1950).
The low-current d.-c. arc enables a 2-stage volatilization of 100-mg. samples of Fe catalysts contg. K. K is volatilized during the first stage and can be estd. from the length of the sector line at 4047.2 Å. The working curve is prepd. from chemically analyzed catalyst dild. with pure Fe_2O_3 . With a closely controlled d.-c. arc, the time of initial volatilization is a secondary check. The range is 0.01 to upwards of 1% with av. deviation of 5-10%.
3384. FELDMAN, C., HAWKINS, M. B., MURRAY, M., AND WARD, D. R.
Spectrochemical Analysis of Radioactive Solutions.
Anal. Chem., 22, 1400-3 (1950).
C. A., 45, 1877b (1951).
A description is given of a chamber designed to permit electrodes for spectrochem. analysis to be loaded outside the spectrochem. lab., excited with spark or other intermittent excitation, and disposed of with min. risk to personnel. If strippable films are used to protect the most heavily exposed surfaces, residual radiation levels of approx. 2 mr./hr. at contact on the chamber parts can easily be attained for the samples customarily encountered.
3385. FETTERLEY, G. H. AND HAZEL, W. M.
A D.-C. Arc Source and Automatic Controller.
J. Optical Soc. Am., 40, 76-9 (1950).
C. A., 44, 2802h (1950).
For the spectrochem. analysis of abrasives and refractories, the d.-c. arc is the only practical source. An effective source of direct current having any desired output up to 45 amp. at 150 v. is described; it is small, light, and inexpensive, and maintenance requirements are negligible. An automatic current controller, described as a separate unit, can be used to hold the current within ± 0.5 amp. at any selected value between 5 and 15 amperes.
3386. FIELDS, L. B. AND CHARLES, G. W.
A Spectrographic Investigation of Trace Elements in Human Teeth.
Proc. Okla. Acad. Sci., 31, 47-8 (1950).
C. A., 46, 6715h (1952).
Spectrographic analysis of unfilled (I) and filling-free sections of filled (II) teeth showed Ca, Mg, P, Na, Cu, and Zn in all, and B in

some. II sometimes contained Sn, Hg, Au, Pd, and Bi. The increase in concn. of Ag, Zn, Sn, and Pb with approach to the crown of the tooth in II but not I is evidence for migration of restoration metals.

3386a. FILIMONOV, L. N.

Method for Increasing Accuracy and Sensitivity of Spectral Analysis of High-purity Copper.

Zavodskaya Lab., 16, 1200-7 (1950).

C. A., 47, 3176b (1953).

The chief cause of variation of relative intensity of spectral lines with time is the incompleteness of the oxidation process, which results in variation of compn. The effect of burning can be practically completely suppressed by converting the neg. sample into an oxide melt; this is accomplished by a sharp increase in reproducibility of analyses of all admixts., with sufficiently high sensitivity. In some cases the sample can be oxidized partially and the greater portion concd. in a small vol. of the oxides. The sensitivity of detn. of volatile admixts. can be increased by fractional distn. of the oxide melt placed on an anode support. Detailed procedures are given.

3387. FISHMAN, I. S.

The Displacement of Calibration Curves in Spectral Analysis.

Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., 14, 586-9 (1950).

C. A., 45, 6955b (1951).

F. plots $\Delta S/\gamma$ vs. $\ln C$ to account for changes in the contrast (γ) of the photographic plate. Studies were made on a Mg alloy and solns. of $MgSO_4 \cdot 7H_2O$ and NH_4 alums as standards on lines Mg I 2852.13 Å and Mg II 2790.79 Å to show the influence of reabsorption. The slopes of the calibration curves are identical in points of equal intensity of the analytical line.

3388. FRED, M. AND SCRIBNER, B. F.

Spectrochemical Methods.

Natl. Nuclear Energy Ser., Div. VIII-1, Anal. Chem. Manhattan Project, 615-43 (1950).

C. A., 45, 1899d (1951).

A general discussion of spectrochem. methods, description of fundamental principles upon which they are based, reason for the adoption of each method, and comparison of their effectiveness for different problems. The typical sensitivity limits of tests for detg. 70 elements possibly present in U_3O_8 is shown for the carrier-distn. method and for the Cu-spark method. The necessary equipment, standards, and methods are discussed. 100 references.

3389. FRISH, S. E.

Reabsorption of Light in a Gas Discharge and Some Applications.

Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., 14, 711-15 (1950).

C. A., 45, 4130i (1951).

It is shown theoretically that reabsorption modifies the intensity distribution of spectral lines. If 2 lines have a common low level, reabsorption lowers the ratio of intensities. In case of a common upper level, reabsorption can lower or raise this ratio. These relations were verified on a Cs-vapor discharge at vapor pressures 4.3×10^{-4} , 1×10^{-3} , and 2.5×10^{-3} mm. Cs. The intensities of the lines Cs I 6011, 6212, 6430, and 6432 Å. taken across and along the tube are plotted as a function of the electron concn. The results obtained from measurements of reabsorption for the concn. of Cs atoms are in good agreement with the concns. calcd. from vapor-pressure data. A system of quant. analysis is proposed in which the light of a discharge tube with pure inert gas A falls on a photocell through a second discharge tube operating in a mixt. A + B.

3390. GARTON, F. W. J. AND WEBB, R. J.
Display Microphotometry.

Colloque intern. spectrographie, Strasbourg Oct., 1950, 127-43.

C. A., 46, 6490c (1952).

A method for scanning the spectrum and displaying the blackening contour of very faint lines on the screen of a cathode-ray tube affords a very rapid and sensitive means of quant. measurement of the underexposed portion of a spectrogram; these portions are normally of little value to the spectrographer. The app. (cf. *C. A.*, 44, 7150e) is more rapid in operation than the usual microphotometer. A slit width of not more than 100 μ , a scan amplitude of not more than 0.5 mm., and a scanning speed of 15 cycles per min. represent optimum operating conditions. The linear parameters of the standard curve obtained by this technique indicate other potential uses, such as in detn. of limits of detection and of "blanks." The flexibility of the cathode-ray tube offers advantages over the conventional pen-recording instruments.

3391. GATTERER, A.

Determination of the Halogens and Also of Sulphur and Selenium by Spectrochemical Methods.

Colloque intern. Spectrographie Strasbourg, Oct. 1950, 173-9.

Qual. and quant. spectrochem. analyses of S, Se, and the halogens may be made simply and speedily by exciting the test samples, in an evacuated hard-glass tube, with a

high - frequency electrodeless discharge. Samples of 10 to 20 mg. wt. may be analyzed for impurities of 0.03% concn. with an error of 10%. The sensitive spectral lines for such analyses are: 4819.39 and 4810.01 Å for Cl; 4785.50 and 4704.86 Å for Br; 5161.19 Å for I; 5453.88 and 5432.83 Å for S; 5096.57 and 5068.65 Å for Se.

3392. GATTERER, A.

Spectrographical Research for Traces.

Met. ital., 42, 244-8 (1950).

C. A., 45, 1901e (1951).

A review discussing the rationale of spectrographic methods for trace metals. Prepn. and excitation of the sample, use of the spectrograph, photography, and interpretation of spectral records are discussed.

3393. GEILMANN, W. AND ISERMEYER, H.

Microchemical Flame Tests.

Z. anal. Chem., 131, 249-62 (1950).

C. A., 45, 491g (1951).

Expts. with 19 elements show that, by refinements, it is possible to use Bunsen flame tests for detecting a few γ of a constituent in a very small sample. Full details are given for making the tests and disturbances are noted.

3394. GHOSH, M. K. AND MAZUMDER, K. C.

Spectrochemical Analysis of Molybdenum in Green Peas.

Indian J. Phys. 24, 67-72 (1950).

C. A., 46, 5741i (1952).

The spectrum of green-pea ash consists chiefly of lines of P, Mg, Ca, K, and Al. Lines of Zn, Mn, Mo, Cu, Na, Ba, Fe, and Si are also found; from the intensities of the lines the latter group of elements can be considered to be trace elements in peas. Mo contents of ashes are 0.015% for Indian peas and 0.007% for canned American peas.

3395. GILBERT, P. T., JR., HAWES, R. C.,

AND BECKMAN, A. O.

Beckman Flame Spectrophotometer.

Anal. Chem., 22, 772-8 (1950).

C. A., 44, 7592g (1950).

A new flame spectrophotometer which is equipped with a special O-gas flame and atomizer unit is described. Owing to the hot flame it is possible to det. more than half the elements. The accuracy attained is a few tenths of 1% of the amount of test element present. Only a few drops of sample are required. Since cleaning between samples is not required the procedure is rapid and convenient.

3396. GILLIS, J. AND ECKHOUT, M. J.

Comparative Study of the Results of Spectro- and Chemical Analysis, Importance of Standards.

Colloque intern. Spectrographie Strasbourg, Oct. 1950, 31-55.

The results of spectrochemical analysis are normally computed from a curve obtained by means of standard samples having compositions known by chemical analysis. To determine the accuracy of the spectrochemical results, comparisons are made with those obtained from chemical analysis. Results of investigations on loams, clays and scorias were compared with those obtained by several chemical laboratories and now some doubts are expressed as to the significance of such a comparison. A large number of such comparisons showed that spectrochemical determinations of some components give better results than those obtained by chemical analysis in industrial laboratories. Sometimes it is not possible to plot a calibration curve with satisfactory precision because of the marked scatter of the results of chemical analyses carried out in different laboratories. It is therefore concluded that there is a lack of standard samples of accurately known compositions. The creation of an Institute for the preparation of standard samples and for the analysis of samples, using precise and standardized methods, would be of great theoretical and practical value.

3397. GILLIS, J. AND ECKHOUT, J.

Spectrochemical Analysis of Clays.

Silicates ind., 15, *Journées études COBEA (Com. belge études argiles)*, 213-19 (1950); cf. *C. A.*, 44, 7034g.

C. A., 44, 10279g (1950).

Details of app., various procedures, and preferred spark and arc methods are given. The results are more precise than those from chem. methods, and traces of materials can be discovered. A table of the range of concn. of various components of clays is shown.

3398. GLANSOLM, D. AND KLEMAN, B.

Use of Photomultipliers in Spectroscopy.

Arkiv Fysik, 2, 305-20 (1950).

C. A., 45, 2314e (1951).

Use of the photoelec. cell as a detector in spectroscopic investigations in the optical wavelength region has increased greatly since the recent introduction of the com. photomultiplier. Some characteristics (linearity, fatigue, noise, and dark current) of 9-stage multipliers are investigated in connection with their use in spectroscopic research. Automatic recording is done by a scanning method, and the simple mech. construction can be applied to any ordinary spectrograph designed for photographic recording. The resolution and sensitivity of the multiplier app. are compared with those of the photographic plate by studies of hyperfine structure in Hg lines, broadening

of Na absorption lines by gas pressure, and intensity distribution among lines in AlH band spectra.

3399. GORDON, G. AND CADY, W. M.

Apparatus for Time-resolved Spectroscopy.
J. Optical Soc. Am., **40**, 852-3 (1950).
C. A., **45**, 1871c (1951).

Conventional methods of spectroscopy afford information on the time integral of the light intensity as a function of wavelength. Commonly no time variation in the source can be deduced. This limitation is particularly apparent if the source is a single spark or an exploding wire, for which the duration is often less than a few microsec. In order to observe the changes suffered by the spectrum of such a source during a single flash, at least two courses have been reported. In one, a Kerr cell or other fast-acting shutter can be installed in the light path of the spectrograph; in the other, there may be brought about a relative motion of the spectrum and the photographic emulsion. An app. is described for making time-resolved spectrograms of single sparks or other short-time sources of light. The adaption of a conventional quartz spectrograph provides for sweeping the image of a selected region of the light source along the length of the slit by means of a rotating mirror. The time base can be made as short as 10 microsec. and time resolution of events in the source as brief as 0.5 μ sec.

3400. GRAF, D. L. AND KERR, P. F.

Trace-element Studies, Santa Rita, New Mexico.
Bull. Geol. Soc. Am., **61**, 1023-52 (1950).
C. A., **46**, 2452i (1952).

The distribution of trace elements, as studied by emission spectrography, in limestones surrounding Pb-Zn ore bodies is presented and discussed. Graphs are given which show the relative intensity values for Mn, V, Cu, Pb, Ag, and Zn for both Tertiary tuffs and latites (surface) and Tertiary clays (drill cores); values for Al, Mn, Cu, Pb, Ag, and Zn are given for surface and underground limestone specimens. Pb is an ideal tracer element in all areas while Zn is useful. V and Cu are not sufficiently abundant in primary ore suite to be detectable in country rock above the background content, and Ag is significant only in Tertiary clays for the same reason. Mn and Al are not contemporaneous with ore, and in Tertiary Mn is too widespread to be useful. Such studies appear to represent a logical and more precise extension of present techniques for inspecting fault gouges and searching for mineralization along faults and joints.

3401. GREEN, M.

Three-line Method of Obtaining Charac-

teristic Curves for Heterochromous Photometry.

J. Optical Soc. Am., **40**, 842-4 (1950).
C. A., **45**, 1871h (1951).

The internal standard method of quant. spectrochem. analysis requires the detn. of the intensity ratio of two spectrum lines, namely, the ratio of the intensity of the analysis line to the intensity of the internal standard line. Often the log of the intensity ratio can be employed instead of the intensity ratio itself. If the 2 lines differ very little in wavelength only a local calibration of the photographic emulsion is necessary. However, when the 2 lines, the relative intensities of which are to be detd., lie in different regions of the spectrum, the problem is slightly more complicated. By employing 3 homologous spectrum lines, 2 in one wavelength range, and a third in the second wavelength range, it is possible to construct the 2 characteristic curves for heterochromous photometry. Spectra contg. the 3 lines are recorded, at several levels of d., on the photographic emulsion to be calibrated. This provides data for a homochromous and a heterochromous preliminary curve. Calibration curves are constructed in the usual manner from these 2 preliminary curves.

3401a. GRIKIT, I. A.

Effect of Heat-treatment and Deformation of Aluminum Bronzes on Results of Spectral Analysis.
Zavodskaya Lab., **16**, 1253-4 (1950).
C. A., **47**, 3181d (1953).

When using arc and spark sources of light the results are practically the same for cast and forged specimens which have been or have not been heat-treated.

3402. HABERLANDT, H. AND SCHROLL, E.

The Color and Fluorescence of Wulfenite in Relation to the Content of Chromium and Other Trace Elements.
Experientia, **6**, 89-90 (1950) (in German).
C. A., **44**, 7719i (1950).

The colors of yellow and red of wulfenites are due to traces of Cr, presumably as chromate, to the extent of 0.003-0.26% as shown by spectrographic and colorimetric analyses. Wulfenites contain 0.001-1.0% V. An Arizona wulfenite contains about 0.1% Nd and Pr.

3403. HAHN, R. B.

Flame Tests in the Presence of Sodium.
J. Chem. Education, **27**, 597 (1950).
C. A., **45**, 2365e (1951).

The advantage of Dy over Co glass filters is shown by transmission curves of the two filters.

3404. HALSTEAD, W. J. AND CHAITKEN, B.
Flame-photometer Determination of Sodium and Potassium in Soils and Other Siliceous Materials.

Public Roads, 26, No. 5, 99-104, 98 (1950).
C. A., 45, 796i (1951).

The flame photometer is described for use in detg. the alkalis in materials which are not easily decompd. by mineral acids. Essentially, the sample is decompd. by fusion and the melt leached with hot water. The alkalis are detd. by the flame photometer (by using the direct intensity method). Soils, sands, rocks, minerals, ceramic clays, fly ash, pozzolana, slag and natural cements as well as limestones and other calcareous materials can be analyzed. A bibliographic reference list is included.

3405. HANNICK, A. AND HANS, A.

Spectrochemical Analysis of Steels, Cast Iron, and Zinc.

Rev. mét., 47, 134-8 (1950).

An ARL multisource and 2-m. spectrograph are applied to the determination of Mn, Si, Ni, Cr, Mo, V, Cu, Sn, and B in steels, Mn and Si in cast irons, and Pb, Cu, Sn, and Cd in zinc. Details are given concerning operation conditions, analysis lines, ranges of concentration, and standard deviations.

3406. HANS, A.

Determination of Brasses by Direct Spectral Analysis.

Congr. groupe. avance. method. anal. spectrograph. produits mét., 13, 75-9 (1950).

A direct-reading spectrometer designed for the analysis of steel is shown to be applicable to brass and it permits the determination of major as well as minor constituents, with an error often less than 1%. The direct-reading apparatus consists essentially of electron-multiplier photo tubes, condensers to integrate the currents emitted by these tubes, stopping the charging of condensers coupled to analysis elements when the charge of the primary element reaches a reference level, and measuring the voltage of different capacities connected to the analysis elements.

3407. HANS, A.

Rapid Analysis of Phosphorus.

Rev. univ. mines, 6, 73 (1950).

Spectrochim. Acta, 4, 416 (1951) (an abstract).

The rapid detn. of P in steel was investigated by numerous studies on the selection of samples, conditions of excitation, form of electrodes, choice of analysis lines, type of detectors, etc. With an installation for direct analysis with two electron multiplier phototubes it is possible to make a detn. of P with a mean-square error of 6 to 7%.

If one uses a Geiger counter for the P line and a multiplier for the reference line the error is reduced to about 2.5%.

3408. HANS, A.

Rapid Estimation of Phosphorus in Steels.

J. Iron Steel Inst. (London), 166, 118-22 (1950).

C. A., 45, 979d (1951).

In a spectrographic method, Geiger-Müller counters are used instead of electron multiplier cells. A special arc discharge which weakens the line in the neighborhood of the 2149 P line is preferred. The standard deviation of the method is about 2.5% and the analysis time is 50 sec.

3409. HANS, A. AND LACOMBLE, L.

What Can be Expected from the Use of Spectrochemistry in Ferrous Metallurgy.

Rev. universelle mines, 6, 230-6 (1950).

C. A., 44, 10580h (1950).

Methods and app. are described and graphical results are given for the detn. of Mn, Si, Ni, Cr, Mo, and W in steel.

3410. HARMON, D. D.

Slide Rule for Quantitative Spectrochemical Analysis.

Anal. Chem., 22, 1227-8 (1950).

C. A., 45, 396c (1951).

A slide rule which carries the calibration curve as a transmittance scale on the base of the rule and working curves as concn. scales on the slide is described.

3411. HARVEY, C. E.

Spectrochemical Procedures.

Glendale, Calif.: Applied Research Labs. (1950), 402 pp.

This is a guide to the development of spectrochemical procedures and their application, written from a practical viewpoint. The major topics treated are: the bases of spectrochemistry, instruments, photographic calibration, spectra of the elements, qualitative analysis, semiquantitative analysis, basic problems of quantitative analysis, standards for spectrochemical analysis, spectrochemical calculations, variables, quantitative procedures, and setting up a laboratory. A feature of the book is the set of useful instructions on the analysis of miscellaneous samples, their treatment prior to analysis, and the procurement or preparation of suitable standard samples.

3412. HASLER, M. F.

Analysis of Stainless Steels with the Aid of the ARL Quantometer.

Colloque intern. Spectrographie Strasbourg, Oct. 1950, 75-9.

C. A., 46, 6037a (1952).

A general method for the rapid quant. analysis of all types of stainless steel uses point-to-plane electrodes, multisource excitation and ARL quantometer calibrated with pairs of standards representing high and low content of each element. Analysis lines are listed for Cr, Ni, Mn, Si, Mo, Ti, Cb, and W in addition to Fe 2714.4 Å which serves as internal standard.

3413. HASLER, M. F.

Convenient Method of Calculation for Spectral Analysis of Multi-Component Systems.

Colloque intern. Spectrographie Strasbourg, Oct. 1950, 61-73.

C. A., **46**, 5974c (1952).

The direct analysis of stainless steels, high speed tool steels and copper alloys in which the concn. of the basic metal varies considerably poses problems with regard to accuracy and speed. When the concn. of the basic metal varies between wide limits a correction factor must be applied to line intensity ratios to obtain correct values for the concn. However, if the alloying constituents are small the influence of the concn. of the basic metal is negligible. The theory of the method of calc. the correction factor is described and examples are quoted of the accuracy attained by applying this method to analyses by means of the ARL quantometer. Providing excitation conditions which minimize variations in the concns. of minor elements, the method enables direct analyses to be made with speed and accuracy and with a limited number of standard alloys, even with samples of widely differing composition.

3414. HÉBERT, R.

Contribution to the Study of the Physico-chemical Structure of Clays.

Ann. mines, **139**, No. 6, 3-54 (1950).

C. A., **45**, 1919c (1951).

For the thick section (about 80 m.) of alternating marls and gypsum beds comprising a section at Cormelles en Pairisis, wet chem., spectrographic, differential thermal, thermogravimetric, x-ray, and optical analyses are made. The clays are sometimes bravaisite sometimes palygorskite, and often seem to be related to both groups. The thermobalance was most suitable for quant. estn. for the dolomite, calcite, and gypsum. Trace elements observed spectrographically included Cu, Be, Mn, Mo, Ni, Pb, V, Zr, Li, Ag, As, Ba, Co, Cr, Sn, Sr, Au, Cd, Ga, and Zn.

3415. HEINZELMAN, D. C. AND O'CONNOR, R. T.

Trace Metals in Cotton Fiber.

Textile Research J., **20**, 805-7 (1950).

C. A., **45**, 865d (1951).

The lint of 8 varieties of cotton grown in 1

location and of 1 variety grown in 13 locations was analyzed for trace metals by the line-width method of spectrochem. analysis to provide compositional data on the presence of metals which catalyze the degradation of cotton cellulose. The highest, the lowest, and the av. values, calcd. on a moisture-free basis, for Cu, Fe, and Mn were: 4.01, 0.68, and 1.57; 13.77, 3.74, and 0.03; and 12.39, 2.79, and 6.92 ppm., resp. Spectrograms showed trace amts. of Al, B, and Zn, but none of Cr, Ni, or Sn.

3416. HERDLE, A. J. AND WOLTHORN, H. J.

Silica Refractories.

Anal. Chem., **22**, 622 (1950).

C. A., **44**, 5071f (1950).

Addnl. work is reported on the detn. of CaO. (cf. *C. A.*, **43**, 7656b)

3417. HODGES, R. M., MACDONALD, N. S., NUSBAUM, R., AND STEARNS, R., EZZMIRLIAN, F., SPAIN, P., and MCARTHUR, C.

Strontium Content of Human Bones.

J. Biol. Chem., **185**, 519-24 (1950).

C. A., **44**, 10870c (1950).

Sr was detd. spectrographically on bone samples from 26 individuals varying in age from fetus to 75 yrs. and on 12 cadavers that had been preserved for 35 yrs. Fetal specimens averaged 0.016% Sr and other samples (including those from cadavers) 0.024%. The level in one hydrocephalic child was 0.054%. No differences were observed between parietal, vertebral, rib, and femur bones.

3418. HODGMAN, C. D. (Editor).

Handbook of Chemistry and Physics, 32nd Ed. 1950-51.

Chem. Rubber Pub. Co., Cleveland, Ohio (1950).

Included in this useful handbook are newly revised tables of wavelengths and relative intensities of the emission spectra of the chemical elements listed by elements from pages 2248 to 2421. Revised editions of this handbook are published at one to two year intervals.

3419. HORTON, L. AND AUBREY, K. V.

Distribution of Minor Elements in Vitrain —Three Vitrains from the Barnsley Seam.

J. Soc. Chem. Ind. (London), **69**, Suppl. No. 1, S 41-8 (1950).

C. A., **45**, 6977d (1951).

Spectrographic analyses for 18 minor elements of vitrains of different ds.

3420. HUGO, T. J.

The Spectrochemical Determination of Magnesium in Cast Iron.

J. S. African Chem. Inst., **3**, 17-22 (1950).
C. A., **46**, 10046b (1952).

A "wet" spark and d.-c. arc method for detn. of Mg in ductile cast iron are described. The slowness of soln. methods can be overcome by use of an illustrated graphite electrode assembly. Secondary inductance and electrode sepn. must be critically controlled to prevent effects on the intensity ratios of the analysis line pairs. Very pure electrodes are necessary. The Seidel-function is used instead of the density to provide straight line calibrations. An operator and one assistant can analyze 40 to 50 samples in triplicate in 7 hr. Line pair Mg 2802.7/Fe 2804.5 is used from 0.01 to 0.1% Mg with 4% standard deviation; and line pair Mg 2790.8/Fe 2788.1 for 0.01 to 0.4% Mg with a standard deviation of 5%, with improvement to 3% by analysis in triplicate. In the d.-c. arc method the soln. is evapd. on the cup electrode at 300° in two steps of 0.05 ml. each. Line pair Mg 2802.7/Fe 2779.3 is used for 0.01 to 0.1% Mg and line pair Mg 2779.8/Fe 2779.3 above 0.1%, both with a 7% standard deviation. Only 30 samples in 7 hrs. can be analyzed by this method.

3421. HULTHÉN, E. AND LIND, E.
Diffraction Gratings and the Plane Mirror.
Ark. Fys. (Stockholm), **2**, 253-70 (1950).
Spectrochim. Acta, **4**, 417 (1951).

A grating mounting is described where the grating (plane or concave) twice diffracts the beam of light with the aid of a plane mirror. This arrangement permits the utilization of the blaze effect, and is shown to gain high brilliancy and resolution in the spectrum.

3422. HUNTER, R. G. AND HEADLEE, A. J. W.
Spectrographic Analysis of Coal and Coal Ash.
Anal. Chem., **22**, 441-5 (1950).
C. A., **44**, 5562g (1950).

Samples of coal are ground to 200-mesh and mixed. Five mg. of sample are placed in a graphite electrode, and heated for 10 min. at 550° in an electric muffle to drive off volatile matter. The samples are run as the pos. pole of a 220 v. d.-c. arc and burned to completion. A logarithmic step sector is used with each exposure. Densitometer readings of spectrum lines in an unknown sample are compared with those of a chemically analyzed sample run on the same plate, thus yielding a quant. analysis. The chem. analysis of the standard was checked against a synthetic standard. Analysis included oxides of Si, Fe, Al, Ti, Ca, Mg, and Na, and K. Data are given on comparative analyses of wet and spectrographic methods on 70 samples. Results of these two analyses of ash content are found to check within 1%

in 97% of the tests, but systematic differences are found for several of the oxides.

3423. ISAEV, N. G.
Quantitative Local Spectral Analysis.
Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., **14**, 689-92 (1950).
C. A., **45**, 6954f (1951).

Two methods are used: (1) The photographic plate moves across the 0.5-mm. slit with a speed of 0.21 mm./min. giving 2.5 min. exposure time. The sample moves 0.06 mm./min. With 1 mm. of sample 7 measurements of intensity are made. A package of thin plates photographed on the same plate is used as a standard. Examples of different steels having nonuniform Cr distribution are given, together with working curves. (2) In the second method both photographic plate and sample are not moving and a spark is produced between the sample and a razor blade parallel to it. The spark is reproduced as a large spectrogram. Details of the setup are given.

3424. IVANOVA, T. F.
Local Spectral Analysis of Steel.
Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., **14**, 686-8 (1950).
C. A., **45**, 6965i (1951).

Mn, Cr, Ni, and Mo can be detd. in areas 0.1 mm. in diam. A piece of mica is cemented airtight on the polished metal surface by an alk. shellac soln., and dried 10-12 hr. at 30°. The work piece is set up in a special electrode holder and perforated by a sapphire needle mounted on a rotating microscope head which also serves for measuring the opening. A Feussner spark is used as light source. Line pairs, procedure, and errors for small (0.1-0.15 mm.) and "large" (0.3-0.4 mm.) surfaces are indicated.

3425. IVANTSOV, L. M., MALININA, V. I., AND POLYAKOVA, V. V.
The Use of the Steeloscope with Improved Photometric Ocular for the Rapid Analysis of Metals and Alloys.
Zavodskaya Lab., **16**, 453-7 (1950).
C. A., **46**, 788h (1952).

The d. "wedge" is a thin circular strip deposited on a disk which rotates in the plane of the spectrum; the strip is made to cover the base metal comparison line. The disk is rotated until this line has the same apparent intensity as the minor constituent line. The position of the disk is noted, and the compn. read from a previously prepd. working curve.

3426. JANSCH, H. AND MAYER, F. X.
Detection and Determination of Thallium in Parts of Cadavers by Chemical and by Spectral Means.

Mikrochemie ver. Mikrochim. Acta. 35, 310-19 (1950).

C. A., 44, 7711h (1950).

Full details are given of the treatment given various parts of the body to obtain an acid soln. after destroying all org. matter with eventual pptn. as Tl_2S . The importance of emission spectral analysis for the detection of inorg. poisons is shown by 4 cases taken from actual practice and it is shown that quant. results can be obtained when chem. methods prove inadequate. The examn. of muscular tissue is very important in Tl poisoning because Tl is stored there for long periods. It was possible to detect Tl in the tissues after a victim had survived small quantities of the poison and to prove the presence of Tl in the remains that had been buried 7 years. In both cases quant. results were obtained.

3427. JASCHECK, W.

A New Spectrum Projector.

Microscopie, 5, 198-9 (1950).

Spectrochim. Acta, 4, 417 (1951).

A spectrum projector giving 10 or 20 fold magnification and permitting plate motion in two directions at right angles is described.

3428. JAYCOX, E. K.

Quantitative Spectrochemical Analysis of Ashes, Deposits, Liquids, and Miscellaneous Samples.

Anal. Chem., 22, 1115-18 (1950).

C. A., 45, 1464c (1951).

Highly buffered spectrographic standards are used for the analysis of widely variant materials. CuO and $PbSO_4$ make satisfactory buffers and by means of special techniques are made to contain 0.001 to 1.0% of the elements to be detd. These are limited to 5 or 6 in any one series of standards. Samples (rubber, plastics, paper and cloth, water, oils and other liquids, miscellaneous solid materials, and deposits) are treated in various ways; in all cases they are mineralized where necessary and incorporated with appropriate proportions of buffer. Selected Pb or Cu lines serve as internal standards. Exptl. details and general precautions are given. Line pairs are listed for 23 elements and general accuracy under best conditions is $\pm 10-15\%$.

3429. JEAN, M.

Different methods of spectrographic analysis of steel.

Congr. groupe. avance. method. anal. spectrograph. produits mët., 13, 15-29 (1950).

In quantitative spectrochemical analyses the results may be obtained from optical densities of spectral lines by three classical modes, the method of external standards, the method of plate characteristic, and the method of internal standards. After pre-

sending the theory of these methods they are compared experimentally by reporting the standard deviations in determinations of Si, Mn, Ni, Cr, and Mo in steels. The order of magnitude of the standard deviation is the same with different methods.

3430. KAISER, H.

Connection of the Spectral Character of Spark Discharges with the Electrical Data.

Colloque intern. spectrographie Strasbourg, Oct., 1950, 149-53.

C. A., 46, 6516c (1952).

The triggering of spark sources controls the elec. const. of the circuits. Sparks can be produced by means of a Feussner spark source (17,000 v.) or a Multisource (1000 v.) which are spectroscopically equiv. Investigations have shown that the following two parameters completely det. the spectral character of the discharge: (1) the energy dissipated in a single train of oscillations and (2) the duration of such a train. Neither the frequency nor the condenser voltage is important, so that with the discharges commonly used, two parameters only are sufficient to define the spectral characteristics of a spark source.

3431. KAISER, H.

Systematic Theory of Spectrochemical Evaluation.

Colloque intern. Spectrographie Strasbourg, Oct. 1950, 181.

C. A., 46, 6029h (1952).

Short-cuts are suggested for the numerical work in spectrochem. analysis.

3432. KAISER, H.

A New Calculating Device for Spectrochemical Analysis.

Colloque intern. Spectrographie Strasbourg, Oct. 1950, 183-4.

C. A., 46, 5897i (1952).

A new device is described for making rapid calculations in spectrochem. analysis. It incorporates several improvements over the original Owens device (*C. A.*, 32, 2028^g) and may be purchased under the trade name "Respektra" from Dennert and Pape, Juliusstr. 10, Hamburg-Altona, Germany.

3433. KAKIHANA, H.

Qualitative Spectrochemical Analysis of Flue Dusts Mainly Produced in Japan.

III. Indium.

J. Chem. Soc. Japan, Pure Chem. Sect. 71, 145-8 (1950).

C. A., 45, 4183c (1951).

cf. *C. A.*, 45, 2647f.

Sixty-three samples of flue dusts produced in Japan and Korea were studied spectro-

graphically and In was detected in 25 of those, produced in the Hosokura mine and the Naoshima smelting works. Indium is generally contained in the dusts, in which Zn, Pb, Sn, Cu, and As were detected as main components and Sb, Bi, Cd, Ge, and Hg are apt to coexist with In.

3434. KAKIHANA, H. AND KEIICHIRO, F.

Intensity Distribution of Band Spectra of CaF and SrF in the Carbon Arc.

J. Chem. Soc. Japan, Pure Chem. Sect., **71**, 341-3 (1950).

C. A., **45**, 5020c (1951).

With mixts. of CaCO_3 or SrCO_3 with NaF in the hole of a C electrode, spectra of CaF (band head 5291 Å) or SrF (band head 5779 and 6521 Å) were found intensively in the neg. flame of the arc, while they were not detected in the center of the arc column.

3435. KALININ, S. K., ALEKSEVA, A. I., YAVNEL, A. A., AND NAIMARK, L. E.

Atlas of Spectral Lines for a Quartz Spectrograph in the Spectral Regions 2050-2500 and 3500-6900 Å.

Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., **14**, 701-2 (1950).

C. A., **45**, 6919h (1951).

The atlas, published by the *Akad. Nauk Kasakh S.S.R., Alma Ata* 1950, consists of 15 plates carrying the Fe spectrum and 595 lines of 51 elements.

3436. KATCHENKOV, S. M.

Application of Spectral Analysis to Geological Cross Sections.

Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., **14**, 670-2 (1950).

C. A., **45**, 6976i (1951).

Spectral analysis of elements occurring in small concns. in sediments can give clues as to their age. Methods employed in systematic analysis and an investigation of Perm deposits of the Buguruslan region are described and it is shown that Sr content can be taken as a good pilot element for Perm-type deposits.

3437. KEIL, A.

A Graphical Method of Evaluating Spectral Samples Containing Third Alloy Components.

Spectrochim. Acta **4**, 165-6 (1950).

C. A., **44**, 10593c (1950).

A graphical method is given to analyze ternary alloys by means of two different series of binary test alloys.

3438. KEIRS, R. J. AND SPECK, S. J.

Determination of Milk Minerals by Flame Photometry.

J. Dairy Sci., **33**, 413-23 (1950).

C. A., **44**, 8012a (1950).

A flame photometer technique suitable for single optical system instruments is described which gives excellent results for Ca, Na, and K in milk. The method consists essentially of detg. the relative spectral intensities of the element in two standard solns., one of slightly higher concn., the other of slightly lower concn. than the unknown. The concn. of the unknown then is calcd. by interpolation. The effects of extraneous ions upon the spectral intensity of the elements detd. are minimized either by incorporating the influencing ions in the standard solns. at concn. levels similar to those found in the unknown solns. or by making appropriate predetd. numerical corrections.

3439. KELLER, R. E. AND SMITH, L.

Simple Vacuum-tube Oscillator—Tesla Coil Source Unit for Spectrographic Analysis.

Proc. Iowa Acad. Sci., **57**, 181-5 (1950).

C. A., **45**, 7874f (1951).

A simple, cheap, high-frequency, portable vacuum-tube oscillator incorporating a Tesla coil has been constructed. The nature of the excitation with metallic electrodes appears to be characteristic of the spark. It is shown that a Tesla coil can be driven by a vacuum-tube oscillator instead of the customary open high-voltage spark. A series of test runs has shown the adaptability of the unit toward metallic electrodes, high-frequency electrodes, and electrodeless discharge tubes. The unit can be utilized for the spectrographic investigation of org. compds. which luminesce and for the investigation of non-conducting materials.

3440. KEMULA, W. AND MICHALSKI, M.

The "interrupted arc" as a source of light in spectral analysis.

Przemysl Chem. **6** (29), 282-8 (1950).

C. A., **45**, 10051b (1951).

The various systems of the "interrupted arc" are described. The wiring diagram described by Pfeilsticker (*Z. Elektrochem.* **43**, 719 (1937); *Z. Metallkunde* **30**, 211 (1938)) is improved upon to give a greater intensity and stability of discharge. The possibility of detecting the spectra of As, P, and C are thus increased.

3441. KHEIFITS, A. L.

Spectral Determination of Small Quantities of Iridium, Platinum, and Rhodium in Palladium.

Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., **14**, 696-7 (1950).

C. A., **45**, 6960g (1951).

Samples contg. Ir, Pt, and Rh in concns. of 0.0005-0.02% were excited in an a.-c. arc and in a spark generator; the arc method

had the higher sensitivity. Pd, Ir, and Pt were tested as chlorides; Rh could be introduced in standards only as Na_2RhCl_4 . Line pairs are indicated for the spark and the arc methods.

3442. KHRSHANOVSKIĬ, S. A.

Industrial Examples of Generators for Spectrum Analysis.

Zavodskaya Lab. 16, 1513-17 (1950).

C. A., 45, 9925a (1952).

Circuit diagrams and constructional features of the generators for spectrographic work are supplied for generator ISP-1, IG-2 (improved version of above) for spark methods, and generator DG-1 for arc methods.

3443. KIBISOV, G. I.

The Low-voltage Spark, Universal Source of Light for Emission Spectral Analysis.

Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., 14, 623-9 (1950).

C. A., 45, 7467f (1951).

A change in parameters of the discharge circuit of the a.-c. arc generator permits a good excitation of the ultraviolet spectrum of Cl, Br, I, S, and Se (Kibisov, *C. A.*, 44, 4370b). These are excited in conditions in which high ionization lines of metals (such as CuIII 2482.34 Å) are also excited; therefore the set up can be advantageously applied to metal analysis. Working conditions of the generator, working curves, and line pairs are given for the detn. of Sn, Zn, and Pb in bronze, for Mn, Mg, Cu, Fe, Si in Al alloys and for Cr, Mn, Si, Mo in steel.

3444. KIBISOV, G. I.

Spectrochemical Determination of Halogens and Sulfur.

Zhur. Anal. Khim., 5, 51-7 (1950).

C. A., 44, 4370b (1950).

Distinct lines for I, Br, Cl, and S were obtained by proper adjustments of the a.-c. elec. circuit of a spark discharge. The desired results were obtained by changing certain conditions in the primary and secondary circuits. Two sets of conditions were detd. most favorable for obtaining distinct lines. In one of these, the capacitance in the discharge circuit is 20 μF , the capacitance in the secondary is 3000 cm., the gap is 1 mm., and the self-inductance in the discharge circuit is for I 112, for Br 37, for Cl 18, and for S 18 μH . In the 2nd set of favorable conditions, the respective values are 60 μF , 15,000 cm., 0.75 mm., and the self-inductance in the discharge circuit is for I 37, for Br 37, for Cl 18, and for S 18 μH . The most sensitive lines for these elements were S 2863.5, 3497.3, and 3838.3; I 3055.3, 3940.1, 2582.8, 3078.8; Br 2389.7, 2926.3; and Cl 3139.2, 3191.4, 3843.2, 3851.5, 3868.8, and 3820.3 Å. Of these S lines 2863.5 and 3497.3, and Cl line

3820.3 Å are doubtful since these lines were obtained also with distd. H_2O . For the present the accuracy of this method is insufficient for quant. work.

3445. KINOSHITA, K. AND MUTA, K.

Minor Elements in the Minerals from the Epithermal Deposits

J. Geol. Soc. (Japan), 56, 423-32 (1950).

C. A., 46, 9025i (1952).

Minor elements in many minerals from epithermal deposits of Japan were detd. by the spectroscope. Distinctive variation of their contents in relation to the kinds of ore bringers and types of ore deposits is noted. Ores from epithermal deposits, related to the Tertiary igneous activity, contains a large quantity of low-temp. elements such as Pb, As, Hg, Ag, and Zn, but are usually free from high-temp. elements. Systematic variation in the quantities of minor elements, in relation to the stage of crystn. or mode of occurrence, has been noted, but no regular relation is observed with the kinds of wall rocks. It is obvious that distribution of minor elements in the minerals depends on the kinds of ore bringer as well as the physicochem. conditions under which mineral deposits were formed.

3446. KLIMENKO, I. E.

Universal Generator for Spectral Analysis.

Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., 14, 618-22 (1950).

C. A., 45, 6930f (1951).

A generator is described with which the following operations can be obtained by simple switching: (1) a.-c. arc, (2) spark superposed on arc, (3) directed spark, (4) "hot" arc, (5) "flaming" arc. Examples of line intensities as a function of the stiffness of operation are given.

3447. KLYNE, W.

The Use of the Flame Photometer in a Clinical Laboratory.

Spectrochim. Acta, 4, 64-5 (1950).

A brief account of the determination of sodium and potassium in blood and urine.

3448. KOEHLER, W.

Sensitive Lines for the Spectral Analysis of Platinum-rhodium Alloys.

Spectrochim. Acta, 4, 229-32 (1950).

C. A., 45, 2367d (1951).

Spectrochem. procedures are necessary for testing purity or failure of Pt-Rh alloys used in chemistry as catalyzers, thermo-elements, etc. Strongly prejudicial to Pt are As, P, Pb, S, Sb, Si, Sn, and Zn; catalysis poisons are Ag, As, Au, P, Pb, and S. A technique is described for the spectrochem. estn. of these elements as trace impurities in Pt-Rh alloys by using spark and also interrupted arc spectra of small foil samples. A

list of lines likely to interfere with the most sensitive lines of the impurities is given. With a spectrograph of av. dispersion the most sensitive undisturbed lines of harmful elements are found to be the following: Ag 3382.9, As 2349.8, Au 2675.9, P 2553.3, Pb 2802.0 and 2833.07, Sb 2311.5, Si 2881.58, Sn 2839.99, and Zn 3345.02 Å.

3449. KOMAROVSKIĬ, A. G.

Influence of Third Elements on the Determination of Tungsten, Cobalt, Molybdenum, Nickel, Chromium, Manganese, Boron, Aluminum, and Niobium in Heat-resisting Steels.

Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., **14**, 572-8 (1950).

C. A., **45**, 6963c (1951).

Forty-eight binary alloys and 64 other heat-resisting and complex-alloyed steels (also contg. C, Si, V, Ti, and Cu) were analyzed spectrographically. Working curves for all elements and a table of line pairs of spectral lines are given. It can be seen that the presence of other elements displaces the straight lines for binary mixts. in the working curves to higher values of the ratio of intensities and parallel to the original lines. It is shown that if suitable curves are selected, the errors in the detn. of the elements can be limited to 2-3%.

3450. KOMAROVSKIĬ, A. G.

Spectroscopic Determination of Magnesium in Cast Iron.

Zavodskaya Lab., **16**, 1132-3 (1950).

C. A., **45**, 1907f (1951).

The spark method or arc between the Cu electrode and the test sample with the following line pairs for comparison: Mg 2802.7 and Fe 2806.97 Å, and Mg 2802.7 and Fe 2793.9 Å, resp., is accurate within 0.001-0.003% in detg. 0.02-0.14% Mg.

3450a. KOMAROVSKIĬ, A. G.

Determination of Small Amounts of Boron in Heat-resistant Steels.

Zavodskaya Lab., **16**, 1228-30 (1950).

C. A., **47**, 3174h (1953).

Analytical lines were B 2496.778 and Fe 2493.25. Four calibration curves were plotted for 4 types of steel. The presence of a 3rd element increases the ratio of intensity of spectral lines; this causes a parallel shift of calibration curves with respect to the curve plotted for the system Fe-B. B content can be either too high or too low, if detn. is not based on a curve corresponding to a given type of steels.

3450b. KOMISSARENKO, V. S.

Spectral Determination of Admixtures in Metallic Cadmium.

Zavodskaya Lab., **16**, 1260-2 (1950).

C. A., **47**, 3174i (1953).

Directions are given for detg. 0.0033-0.5% Cu, 0.0037-0.5% Pb, 0.05-0.2% Ti and 0.005-2.0% Zn.

3451. KOPPIUS, O. G.

Application of Geiger Counter Tubes for Spectrochemical Analysis.

Philips Tech. Rev., **11**, 215-20 (1950).

C. A., **44**, 5709h (1950).

The Geiger counter tube, using the photoelec. effect of the cathode metal, can be applied to the measurement of very feeble visible or ultraviolet radiation. As a direct-indicating instrument for measuring radiation intensities, it can be used in the detection of traces of chem. elements by substituting the counter for the photographic plate in an emission spectrograph. It has been applied industrially to the detection of atm. Pb.

3451a. KORZH, P. D.

Spectral Analysis of Iron Ores.

Zavodskaya Lab., **16**, 1215-18 (1950).

C. A., **47**, 3176h (1953).

Detns. were made of SiO₂, MgO, Fe, CaO, Al₂O₃, and MnO. Lines used were Si 2881.5 and Cu 2824.2, Mg 2802.7 and Cu 2824.4, Fe 2973.2 and Cu 2961.2, Ca 3158.9 and Cu 3108.6, Al 3082.2 and Cu 3108.6, and Mn 2933.1 and Cu 2961.2. The disadvantage of the method is that it is necessary to have standards made of same type of ore.

3451b. KUDELYA, E. S.

Spectral Analysis of Aluminum in Steel.

Zavodskaya Lab., **16**, 1224-8 (1950).

C. A., **47**, 3174c (1953).

The method is applicable for small amts. (0.01-1.00%) Al in steels and in weld seams. The const. electrode was a 5-6 mm. Cu rod. Analytical lines were Al 3082.16 and Fe 3083.74. The condenser spark as a source was better than an a.-c. arc. Relative error depends to a great extent on the length of preliminary sparking; this should be 15-20 sec. Results give total Al in metal (dissolved free metal and oxide). Increase in Al concn. decreases the diam. of the sparking spot.

3452. LAURELL, C. B.

Estimation of Alkali Metals in Blood and Urine by Internal Standard Flame Photometer.

Scand. J. Clin. Lab. Invest., **2**, 257-60 (1950).

C. A., **45**, 5219f (1951).

Estn. of alkali metals with a Perkin-Elmer model 52A is described.

3453. LEUCHS, O.

Chemical Processes in Carbon Electrodes. *Spectrochim. Acta*, **4**, 237-51 (1950).
C. A., **45**, 2339i (1951).

A series of expts. to test the various types of chem. reactions and of diffusion which take place in a boring in a C-arc electrode is described. The high-temp. chem. reactions between elements and C are described in detail. Some of these reactions lead to non-volatile compds., others may take varying courses according to the compn. of the mixt. being examd. A general view of the behavior of various elements when present as the main constituent or as traces is outlined, and the work concludes with some observations on diffusion processes in the C and other phys. variations in arc behavior.

3454. LEVI, G. R.

Immediate, Quantitative Analysis of Sodium, Potassium, and Other Metals.

Arquiv. biol. (São Paulo), **45**, 92-5 (1950).
C. A., **45**, 62b (1951).

A review of spectrophotometry of alk. and alk.-earth metals, especially in tissues. 25 references.

3455. LEXOW, S. G. AND Maneschi, E. P. P.

Germanium in Rio Turbio coal.

Anales asót. quím. argentina, **38**, 225-9 (1950).

C. A., **45**, 4020c (1951).

The ash of this subbituminous coal contained about 0.2%, and up to 0.27%, GeO_2 .

3455a. LIGHTNER, M. W.

Analysis of Iron Implements from Tell Biet Mirsim.

Bull. Am. Schools Oriental Research No., **119**, 22-3 (1950).

C. A., **47**, 9683d (1953).

Spectrographic estimates are tabulated for 23 elements in 5 samples of lime-encrusted Fe implements from Palestine that are believed to date about the 7th century B.C. Quant. analysis of a ploughshare gave: SiO_2 0.58; MnO 0.023; P_2O_5 0.077; S 0.032 (as SO_4 or S) C (as CO_2) 0.45; Fe_2O_3 90.76; Al_2O_3 0.36; NiO 0.12; remainder mostly CaO . The low Ni and Co contents indicate that the Fe is not of meteoric origin. All samples are slightly magnetic; this indicates that the Fe is nearly completely oxidized.

3456. LINSEIS, M.

Modern Physical-Chemical Methods of Investigation Used in Ceramics.

Sprechsaal, **83**, 181-4 (1950).

C. A., **44**, 7499d (1950).

Publications since 1939 on X-ray, thermal, spectroscopic, and polarographic methods of investigation are reviewed.

3457. LOEUILLE, E.

Measurement of the Absolute Intensity of a Line.

Congr. groupe. avance. method. anal. spectrograph. produits mét., **13**, 175-7 (1950).

C. A., **45**, 8871a (1951).

It is known that the spectral distribution of energy from hydrogen lamps varies very little with the mode of discharge and that the wavelength of maximum emission remains at 2250 Å. The total ultraviolet radiation from a hydrogen lamp of Gallois type operated with two amperes has been measured with a thermopile. A method for measuring the absolute intensity of a monochromatic line relative to the calibrated hydrogen lamp is outlined theoretically.

3458. LOMONOSOVA, L. S.

Spectroscopic Determination of Titanium and Niobium in Powdered Tantalum.

Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., **14**, 693-5 (1950).

C. A., **45**, 6963b (1951).

Working curves and operating conditions are given for the line pairs Ti I 3186.45-Ta I 3184.55 Å and Nb 3215.95-Ta II 3223.83 Å.

3459. LOOFBOUROW, J. R.

Microspectroscopy.

J. Optical Soc. Am., **40**, 317-25 (1950).

C. A., **44**, 6273c (1950).

Microspectroscopy involves the combination of microscope and spectroscope optics for the purpose of investigating the spectra of small samples. The general methods of microspectroscopy are described as applied to absorption measurements in the ultraviolet, visible, and infrared regions, emission spectroscopy, and other applications. Recently developed components and systems for microspectroscopy are emphasized, and some of the important requirements for their effective design and use are considered briefly.

3460. LOPEZ DE AZCONA, J. M.

Spectral Control of Thermal Treatment.

Mém. centre natl. recherches mét., Sect. Haïnaut, Dec., **1950**, 45-55.

C. A., **45**, 7499a (1951).

The spectral intensity of various alloy systems under excitation was studied as a function of temp. and thermal treatment. *Aluminum alloys*. Tech. Al, Duralumin, and Al alloy Y were studied. The intensity of certain of the Si, Fe, Cu, Mg, and Mn lines reached a max. at approx. 100° and were a min. at approx. 350°. The intensity ratio ($\text{Al}_{2115}/\text{Mg}_{7791}$) for Duralumin contg. 0.79% Mg was much greater for aged alloys than for quenched alloys. Changes in the intensity ratios ($\text{Al}_{2115}/\text{Mg}_{7791}$) and ($\text{Al}_{2115}/$

Cu_{27%}) after aging for various periods of time were correlated with the production of Al₂Mg₃. In Super-Duralumin alloys the intensity of Cu, Mg, Si, Fe, and Mn spectra exhibited max. at approx. 109° and 250° and min. at approx. 150° and 550°. In Al alloy Y the intensity of aged alloys was greater than that of a homogeneous alloy. *Steels*. Specimens contg. 0.72 and 0.62% C were studied. The intensity ratio (Fe_{II12394-512}/C_{II12396-89}) was measured as a function of temp. Heating and cooling curves exhibited a general similarity of shape but an addnl. max. was observed on the cooling curve and there were slight differences of the max. and min. in the 2 curves. Characteristic "A" pts. on the Fe-C phase diagram were correlated with several of the min. *Sn bronzes*. Alloys contg. 8.1, 12.3, 14.7, 18.2, 23.9, 27.4, and 29.9% Sn were studied. The intensity ratio (Cu₂₈₂₄/Sn₂₈₈₃) was measured as a function of temp. Max. and min. were correlated with pts. on the Cu-Sn phase diagram. *Al bronzes*. The intensity ratio (Cu₂₈₂₄/Al₃₀₉₂) was measured as a function of temp. Correlations with the Al-Cu phase diagram were drawn.

3461. LOPEZ DE AZCONA, J. M. AND CAMUÑAS-PUIG, A.

An Automatic Electric Regulator of Excitation and Exposure of Spectra.

Rev. cienc. aplicada (Madrid), 4, 394-402 (1950).

C. A., 45, 6061c (1951).

An a.c.-operated regulator automatically performs the sequence of closing the excitation circuit, opening and closing the spectrograph shutter, opening the excitation circuit, shifting the plate holder, and indicating completion of the sequence. The steps are timed and controlled by an elec. clock. The electrodes are also automatically illuminated for changing and positioning.

3462. LOPEZ DE AZCONA, J. M. AND CAMUÑAS-PUIG, A.

Study of the Effect of Physical State in the Binary System Sb-Sn.

Congr. groupe. avance. method. anal. spectrograph. produits mét., 13, 31 (1950).

By means of technique described in previous papers the spectroscopic effects of the physical state has been studied in Sb-Sn alloys containing 1, 5, 10, 20, 30, 40, and 50% Sn. After choosing proper conditions of excitation (4.6 kv., 0.0025 μ F, and 0.40 mH) and temperatures from 300° to 500°, the evolution of different phases could be easily followed.

3463. LOPEZ DE AZCONA, J. M., SANTOS RUIZ, A., AND DÉAN GUELBENZU, M.

Search and Determination of Metallic Trace Elements in Foods and Organic Tissues.

Congr. groupe. avance. method. anal. spectrograph. produits mét., 13, 101-2 (1950).

Semiquantitative spectrochemical determinations have been made of trace elements in 39 samples of food, urine, and various organs of suckling and adult rats. In ashed samples burned in direct current arcs the following elements were found: Ca, K, Mg, Na, P, Al, Cu, Fe, Li, Mn, Si, Co, Mo, Ni, Pb, Ti, Ag, B, and V.

3464. LUNDEGÄRDH, P. H.

Aspects of the Geochemistry and Petrology of Plutonic Ultrabasites in Sweden.

Geol. Fören. i Stockholm Förh., 72, 51-63 (1950) (in English).

C. A., 44, 10620i (1950).

Eight chem. and spectrochem. analyses (3 new) of these rocks are presented.

3465. LUNDEGÄRDH, P. H.

Rapid Analysis of Rocks. Some Viewpoints with Special Emphasis on the Possibilities of Use of the Flame Method.

Geol. Fören. i Stockholm Förh., 72, 151-7 (1950).

C. A., 44, 10597b (1950).

The chem. and spectrochem. analysis of rocks is discussed with particular reference to the requirements of petrology and geochemistry. The d.-c. arc commonly used is bound to yield relatively great analytical errors even though the sensitivity is very high. The accuracy of the intermittent-arc method is greater. The Lundegårdh flame method (*Die quant. Spektralanalyse der Elemente*, Tl I, 1929; Tl II, 1934 (*C. A.* 28, 3340³; 31, 2958¹)) and its application to the analysis of silicate rocks is discussed; its explt. errors are small. The method of Schuhknecht (*C. A.*, 31, 4921⁴) for the detn. of K is described, and a combined rapid method is presented, consisting of gravimetric detn. of H₂O, SiO₂, and Al₂O₃, volumetric detn. of FeO, and colorimetric detn. of P₂O₅. Total Fe, Mn, Mg, Ca, Na, and K are detd. by the flame method. Ti is detd. spectrochemically in the arc. The total time required for the analysis is 8 hrs. Further developments and applications of the method are discussed. Two rock analyses made by the method are given. 14 references.

3466. MALAMAND, F.

Spectrographic Determination of Carbon in Ordinary Steels and in Refractory Alloys of the Vitallium Type.

Office natl. études recherches aeronautiques, No. 15, 39-43 (1950).

C. A., 44, 8282c (1950).

A modification of the spectrographic method of Garton (*C. A.*, 42, 2544b) for the detn.

of C in steel gave a mean square error of $\pm 5.1\%$ for samples contg. 0.165–1.05% C. The same method was applied to samples of nonnickelous Vitallium type alloys contg. 0.12–0.96% C with a mean square error of $\pm 5.2\%$. By means of a 15- μ slit, which made possible the sepn. of the 2 normally interfering lines of Ni, satisfactory results were also obtained on 4 Vitalliums contg. 2–5% Ni.

3467. MALYSHEV, V. I.

Methods to Increase the Dispersion of Spectral Apparatus.

Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., 14, 746–52 (1950).

C. A., 45, 4139h (1951).

Two methods are described: (1) positioning the prism in such a way that the angle of incidence is different from the angle of min. deviation; the loss in power and the astigmatism are discussed and it is shown that a system of several prisms at angles slightly different from the angle of min. deviation has advantages and (2) multiple collimation of the light beam with prism and mirrors.

3468. MANDEL'SHTAM, S. L. AND FAL'KOVA, O. B.

Spectrographic Determination of Nitrogen in Steels.

Zavodskaya Lab., 16, 430–8 (1950).

C. A., 46, 1387e (1952).

Method I: A 4.5 microfarad condenser, charged to 16 kv. through a kenotron, discharges through a 4 mm. regulating gap, which is in series with a 0.5-ohm resistor, a 250-microhenry inductance, and the 0.3 mm. analytical gap. The latter is kept in an atm. of 25–30 cc. of CO₂. A series of 10 discharges is used per analysis; the sample is moved between discharges because of local impoverishment of the steel in N. Method II. Samples are kept in 35 cc. of CO₂ and excited by an activated low-voltage intermittent arc with a 110 microfarad power condenser charged to 220 v. Both the series regulating gap and the analytical gap are 0.35 mm. wide. Exposures are short (~ 0.5 sec.) in order to avoid local impoverishment in N. The intensity ratio of N II 3995.0 to the adjacent background is plotted as a function of N content (detd. chemically). The limit of detection is $\sim 0.003\%$ N by both methods; av. deviations for sets of 5 replicates ranged from 6 to 20% of the amt. present.

3469. MARIASSY, M.

The Determination of Iron, Silicon, Copper, and Zinc in Metallurgical Aluminum by Spectral Analysis.

Aluminum, 2, 8–11 (1950).

C. A., 45, 5563i (1951).

The methods used in the Ural Al Factory

described by Druckaia were tested. For the detn. of Fe the pair of lines Fe 2755.7 and Al 3050.07 Å was most suitable at Fe contents of 0.05–60%. The av. error was $\pm 3.2\%$. The av. error was $\pm 3.4\%$ with Fe 2599 and Al 2669 Å. At Si contents of 0.05–60% the lines Si 2881.6 and Al 3050.07 Å were suitable. The av. error was $\pm 4.0\%$. Cu and Zn were not detd. in control work; for single detns. Cu 3247.5 and Al 3082.16 Å (deviation $\pm 5.0\%$) and Zn 2557.96 and Al 3082.16 Å (deviation $\pm 9.8\%$) were satisfactory. A special method was developed for the detn. of V with the pair of lines V 3110.7 and Al 3050.08–3060 Å. The Ti line at 3103.8 Å interfered when the line 3102.3 Å was used. The lines V 3118.4 and 3093.1 Å were unsuitable for quant. work. The error was $\pm 5.2\%$ for V contents of 0.010–0.100%. Electrode distance 2.5 mm. with electrodes of 3 mm. diam., slit width 0.03 mm., self induction 0.08 mh., pre-sparking 0.5 min., and exposure 1 min. gave the best results with Agfa "extra hart blau" plates. The results were reproducible. The increase of capacity in the production of sparks diminished the limits of error.

3470. MASI, O. AND ROSSI, C.

Photometric and Sensitometric Determinations in Spectrography.

Met. ital., 42, 403–9 (1950).

C. A., 45, 4560h (1951).

A crit. review of photometric and sensitometric errors in "absolute" emission spectroscopy. The influence of slits, mono- or polychromaticity, lack of uniform blackening of lines resulting in macro- and micro-defects are discussed in detail.

3471. MATHIEU, F. C.

The Automatic "Spectro-Lecteur" for Spectral Analysis by Direct Reading.

Colloque intern. Spectrographie Strasbourg, Oct. 1950, 87–119.

C. A., 46, 5897f (1952).

The equipment consists of: (1) A reading head in place of the photographic plate, attached to a prism spectrograph of classical design. (2) An operating unit, mechanically connected to the reading head. (3) An amplifier unit with oscilloscope and recording potentiometer. (4) A Faraday Cage shielding screening the source unit and the spark stand.

The reading head contains two photomultiplier tubes. One can be set on a line due to the basic metal (internal standard) while the other can be moved automatically (or manually) along the spectrum to the position of the line chosen for the analysis. During the period of setting on such a line, a potentiometric measurement of the tube signals is recorded on a paper strip. The essential

characteristics of the apparatus consist of the use of the periodicity of the sparks and the considerable advantage (in amplifying the tube signals) offered by a.c. amplification. The instrument is thus not only direct reading, but is also capable of giving instantaneous values. It is possible to follow the variation of the intensity ratio I_x/I_s of two lines as a function of the time of sparking, either visually on the screen of the oscilloscope or graphically on the pen recorder which traces the mean value of the ratio. This property gives the instrument special merits both for general research as well as for automatic analysis, revealing immediately the slightest defects in the sparking circuit, in the optical alignment, etc. Some recorded strips give examples of the variations of line ratios during the sparking period and of automatic analysis, showing the possibilities of the instrument.

3472. MAYER, F. X. AND HOLIK, L.

The Use of Anodically Oxidized Aluminum Electrodes for the Spectrochemical Determination of Traces of Thallium, Lead, Mercury, and Zinc.

Spectrochim. Acta, **4**, 218-23 (1950).
C. A., **45**, 2365e (1951).

Anodically oxidized as well as pre-sparked electrodes of 99.99% pure Al were found especially suitable for the detn. of trace elements because the absorbing surface favors uniform distribution of the sample and the resulting spectra are free of mol. bands. The electrodes are anodically oxidized for 3 hr. at room temp. with d.c. of 0.1 amp./sq. cm. in a dil. electrolyte contg. 35 g. $Al_2(SO_4)_3$ and 25 g. Na_2SO_4 per l. After water rinsing and air drying the electrode is soaked with 0.005 cc. of 0.25 M KCl soln. and the same quantity of test soln. The analysis and internal standard lines, resp., are Tl 3775.72, Co 3845.47 Å Pb 2833.07, Cu 2824.37 Å, Hg 2536.52, Cu 2492.15 Å, and Zn 3345.47, Cd 3403.6 Å. The range of conc. detd. is 10^{-7} to 5×10^{-8} g. when 0.005 cc. of soln. is tested.

3473. McCLELLAND, J. A. C.

Determination of Rare Earths.

Analyst, **75**, 392 (1950).
C. A., **44**, 8820d (1950).

Since the publication of the former paper on the spectrographic detn. of rare earths by the intermittent-arc technique, it has been found that Cu as supporting electrode, in place of graphite, makes the operating conditions simpler and gives spectra relatively free from interfering background, at the cost of a slight loss in sensitivity. Cu is easily obtained in a state of purity and, unlike graphite does not vary with its origin and so affect the detn. of rare earths. It does not give the band spectrum that graphite does, a wider

choice of spectral lines results and the consumption of electrode material is reduced.

3474. MEGGERS, W. F.

Second Annual Review of Analytical Chemistry. Emission Spectroscopy.

Anal. Chem., **22**, 18-23 (1950).
C. A., **44**, 1843c (1950).

An extensive review of fundamental and applied emission spectroscopy with 104 references.

3475. MEGGERS, W. F. AND SCRIBNER, B. F.

Arc and Spark Spectra of Technetium.

J. Research Natl. Bur. Standards, **45**, 476-89 (1950) (Research Paper No. 2161).
C. A., **45**, 3712a (1951).

Four mg. of highly purified Tc lent by the U. S. At. Energy Commission, was used to obtain a description of its arc and spark spectra. Solns. contg. 50 to 200 γ Tc were dried on Cu electrodes and excited by elec. arcs or sparks. A stigmatic concave grating of 22-ft. radius was employed to photograph the spectra from 2200 to 9000 Å, within which limits more than 2300 lines characteristic of Tc atoms or ions were recorded. Wavelengths were measured relative to Fe standards, relative intensities were estd. on a scale of 1 to 1000, and almost every line was definitely assigned either to neutral Tc atoms or to singly charged (Tc^+) ions. The measured wavelengths range from 2261.30 to 8829.80 Å with av. probable errors rarely exceeding ± 0.01 Å. The av. results of wavelength measurements and of intensity estimates for 2121 lines in Tc I and Tc II spectra are presented. The strongest Tc I lines have wavelengths 4297.06, 4262.26, 4238.19, 4031.63, and 3636.10 Å. The strongest Tc II lines have wavelengths 2543.24, 2610.00, and 2647.02 Å. This description of Tc I and Tc II spectra will serve for spectrochem. identification and for structural analyses of these spectra.

3476. MEGGERS, W. F., SHENSTONE, A. G., AND MOORE, C. E.

The First Spectrum of Arsenic.

J. Research Natl. Bur. Standards, **45**, 346-56 (1950) (Research Paper No. 2144).
C. A., **45**, 1868b (1951).

The spectrum emitted by neutral As atoms was observed photographically in the infrared, visible, and ultraviolet, and new lines were discovered in each region. Measured wavelengths and estd. relative intensities are given for 330 lines ranging from 1407.34 to 11679.9 Å and from 1 to 2000 in intensity. More than 74% of the total no. and 97% of the total intensity of observed lines have been explained as combinations of 30 odd energy levels arising from $4s^2 4p^2$ and $4s^2 4p^1 \ n p$ electron configurations and

58 even levels from $4s4p^4$, $4s^24p^2$ ns, and $4s^24p^2$ nd. The av. difference between observed and computed wave nos. is 0.14 cm.^{-1} . Most of the observed levels have been assigned to doublet and quartet terms, and spectral series of the type $4s^24p^2 - 4s^24p^2$ ns have been identified. Calcns. based on these series yield an abs. value of 79165 cm.^{-1} for the ground state $4s^24p^2$ $^3S_{0,1/2}$ of neutral As atoms, that is, an ionization potential of $9.81 \pm 0.01 \text{ e. v.}$

3477. MICHEL, P.

A Comparative Study of the Feussner Generator, the DURR Construction and the Multisource Generator for the Analysis of Steels and Cast Irons.

Congr. groupe. avance. méthod. anal. spectrograph. produits mét., 13, 147-55 (1950).

C. A., 45, 8871a (1951).

3478. MICHEL, P.

Investigation of a Sensitive Emulsion on Film for Rapid Spectrographic Analysis.

Congr. groupe. avance. méthod. anal. spectrograph. produits mét., 13, 157-61 (1950).

C. A., 45, 8871a (1951).

3479. MINAMI, E. AND HONDA, M.

Distribution of Strontium in Natural Calcium Carbonates.

J. Chem. Soc. Japan, Pure Chem. Sect., 71, 266-70 (1950).

C. A., 45, 4614h (1951).

About 150 samples of CaCO_3 consisting of limestone, calcite, aragonite, calcareous skeleton of marine organisms, and natural waters were studied by semiquant. spark method. In most of them the Sr/Ca (at. ratio) was 1-0.03%, while in stalactites it was less than 0.01%. Synthetic expts. cannot reproduce this lack of Sr in stalactites. Aragonite-type substances contained much more Sr than calcite-type substances.

3480. MINGUZZI, C.

Minor Constituents of Elba's Iron Ores.

Spectrographic Determination of Minor Constituents of Hematite and Magnetite.

Atti soc. toscana sci. nat. (Pisa), Mem. 57, Ser. A. 119-44 (1950).

C. A., 46, 2965f (1952).

Ten hematites and 4 magnetites were examd. spectrographically. They contained 0.025 to 0.34% MnO and 0.032 to 0.103% TiO_2 . Moreover, Al, Mg, Si, Cu, Sn, Ca, V, Ni, and Co (in order of decreasing frequency and quantity estd.) were also detected. A possible explanation of the presence of said elements is given.

3481. MINTS, I. M.

Spectral Analysis of Some Magnetic Alloys.

Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., 14, 602-5 (1950).

C. A., 45, 6955f (1951).

All detns. were made with the steelometer. For Alni the line pairs were Al 5696.5/N 5666.6 (12-20% Al); Cu 5153.2/Fe 5133.7 (2-8% Cu, condensed spark); Ni 4714.4/Fe 4736.8 (20-34% Ni, a.-c. arc). In Alsifer (condensed spark) the line pairs were Al 5696.5/N 5666.6 (5-11% Al) and Si 6371/Fe 6301.5/2.5 (5-11% Si). In Fe-Co-Mn-V alloys (a.-c. arc) the lines were Co 4840.3/Fe 4859.8 (10-22% Co), V 4831.6/2.4/Fe 4859.8 (4-11% V), and Mn 4823.5/Fe 4871.3/2.1 (10-20% Mn). Line pairs and set up are also described for the analysis of Magnico. Annealing with slow cooling or fast quenching does not influence the results.

3481a. MISHARIN, G. I. AND SUKHENKO, K. A.

Spectral Analysis of High-alloy Steel.

Zavodskaya Lab., 16, 1256-60 (1950).

C. A., 47, 3180i (1953).

Spectrographic detns. of Si, Cr, Mn, Ni, V, Ti, and Mo during the course of smelting required 15-20 min. Spectrograms were obtained by photometric interpolation. The burning time was 2 min., and a spark interval of 2.5 mm. was used. Calibration curves are given for all 7 elements. Results were satisfactory to control compn. of heat.

3482. MITCHELL, R. L.

Flame Photometry.

Spectrochim. Acta, 4, 62 (1950).

A condensed version of a paper reviewing flame photometry and instruments in that field.

3483. MONFILS, A. AND ROSEN, B.

Spectroscopic Determination of Traces of Nitrogen in Argon.

Rev. universelle mines, 6, 79-81 (1950).

C. A., 44, 5264i (1950).

Two methods have been developed: one uses a hollow cathode and can detect 0.1%; the other applies anodic excitation and permits the detn. of 0.01% with certainty. The best conditions in the latter case are: pressure of 20 mm., 500 v., 200 ma. The shape of the anode is of importance and is described in detail.

3484. MONKHOUSE, A. C.

The Minor Constituents of Coal.

Coke and Gas, 12, 363-8 (1950).

C. A., 45, 2174d (1951).

A discussion of the constituents of coal with particular reference to N, S, P, Cl, F, As, and trace elements. 26 references.

3485. MONTGOMERY, A.

Geochemistry of Tantalum in the Harding Pegmatite, Taos County, New Mexico. *Am. Mineral.*, **35**, 853-66 (1950).
C. A., **45**, 992e (1951).

The pegmatite is unusually rich in Li, Be, and Ta minerals, and shows remarkable vertical zoning of minerals. Where the pegmatite has replaced Ca-rich amphibolites, microlite occurs, where schist has been replaced, tantalite occurs. Spectrographic analysis shows 0.003% Ta in sphene of the Dixon granite. This granite, close to the pegmatite, contains very little sphene; the Ta of the pegmatite may therefore represent material not bound, as elsewhere, in the sphene crystal within the granite.

3486. MONVOISIN, J. AND MAVRODINEANU, R.

Some Improvements in Apparatus for Flame Spectrophotometry. *Spectrochim. Acta*, **4**, 152-6 (1950).
C. A., **44**, 10487f (1950).

The dispersion of the liquid particles in a flame source is improved by building an ultrasonic oscillator into the jet. This oscillator can be used wherever pressures over 0.9 kg./sq. cm. are available. The flame is stabilized by heating the fuel inlet in the base of the burner. The app. is used successfully in the estn. of K and Na in silica-alumina refractories by direct spectrophotometry with filters and barrier-layer photocells.

3487. MOORE, C. E.

An Ultraviolet Multiplet Table. *Circular No. 488*, Sec. 1, 78 pp., National Bureau of Standards, Washington (1950).

An extension of the earlier work "Multiplet Table of Astrophysical Interest" in which classification was given for lines down to 2950 Å. The new table provides classification and excitation energies for lines below 3000 Å for the first 23 elements of the periodic system. Reviewed in *Spectrochim. Acta*, **4**, 255 (1950).

3488. MOSHER, R. E., BIRD, E. J., AND BOYLE, A. J.

Flame Photometric Determination of Calcium in Brucite and Magnesite. *Anal. Chem.*, **22**, 715-17 (1950).
C. A., **44**, 7183d (1950).

By means of a Beckman model DU spectrophotometer and Beckman flame photometer attachment, Ca can be detd. more rapidly than by conventional procedures. The app. must be calibrated against several standard solns. contg. Al and Mg, nitrates, and measured amts. of Ca. By means of a microcapillary aspirating tube, draw the Ca soln. into the mixt. of burner gases. Transmit

the light from the resulting flame to the standard Beckman spectrophotometer assembly, where it is sepd. into its component wave lengths by means of a quartz prism. Focus a narrow region of the spectrum (622 mμ for Ca) through a slit and project it onto a phototube, and measure the intensity.

3489. MOUTET, A. AND BARRÈRE, S.

Emission Spectrography.

O.N.E.R.A. (Office natl. études et recherches aeronaut.), *Pub. No. 46*, 92 pp. (1950).

C. A., **45**, 3705f.

A review with 136 references.

3490. MUKHERJEE, B.

Purification of Carbon Rod by Resistance Heating.

J. Sci. Ind. Research (India), **9B**, 266-8 (1950).

C. A., **45**, 5463g (1951).

Carbon rod, employed as an electrode in the cathode layer arc for spectrum analysis, was purified by passing a current of 570 amp. (max.) for 90 sec. through a rod, 10 cm. long and 7 mm. in diam. A N-Cl atm. was maintained around the electrode by means of a continuous stream of N bubbled through CCl₄. Traces of Fe and Mg were almost completely removed. Cu, which is not completely removed by resistance heating in air, also was almost completely removed. Slight traces of B remained in the rod.

3491. MUKHERJEE, B. AND DUTTA, R.

A Note on the Constituents of the Ashes of Indian Coals Determined Spectroscopically.

Fuel, **29**, No. 8, 190-2 (1950).

C. A., **44**, 8620e (1950).

Spectrum analysis of the ashes of Indian coals revealed the presence of Ag, B, Be, Co, Cr, Cu, Ga, Ge, Li, Mo, Ni, Pb, Sc, V, W, Zr, and also the rare earths Sm, Dy, Eu, Er, Tb, and Nd in traces besides the main constituents found by previous chem. analysis. A fair concn. of Ge, in certain coal ash of the order of 0.1%, was detd. by the logarithmic wedge sector method.

3492. MURAKAMI, Y.

Occurrence of Thallium in Minerals in Japan.

Bull. Chem. Soc. Japan, **23**, 1-2 (1950).

C. A., **45**, 88a (1951).

Chem. and spectroscopic tests (cf. Kimurra, *C. A.*, **31**, 975¹) on 30 minerals showed that marcasite, enargite, sphalerite, and native Bi contain up to 0.1% Tl.

3493. MURPHY, R. W. AND HUGHES, H. K.
Simultaneous Recording of Two Wavelength Ranges with the Littrow Spectrograph.

J. Optical Soc. Am., **40**, 779-81 (1950).

C. A., **45**, 949e (1951).

Two wavelength ranges are recorded from a single exposure by the use of an auxiliary mirror system in a Littrow-type prism spectrograph. Radiation incident on the upper half of the prism-lens aperture receives the dispersion and collimation to produce the normal ultraviolet spectrum on the photographic plate. A system of 2 mirrors, interposed before the lower half-aperture, provides an addnl. angular deviation and increase in path length to produce a visible spectrum adjacent to the ultraviolet spectrum. The instrument described was designed for use with a Bausch and Lomb large Littrow spectrograph. It records, in one exposure, a spectral range sufficient for the detection and approx. estn. of all the elements, except B, which can be excited in an arc. Through the use of the auxiliary unit, the range 2530 to 3500 Å and any 4000 Å between 3540 and 10,000 Å are covered in one exposure, including, e. g., the 4 P lines and the K lines at 7665 and 7699 Å. The elimination of an extra exposure results in substantial reductions in analytical time and in the required size of samples.

3494. MUSA, S.

Quantitative Emission Spectrum Analysis. I. Effects of Variation in the Electrical Supply; Elimination of the Standard Sample for Aluminum-iron Alloys.

Science Repts. Research Insts. Tōhoku Univ., Ser. A, **2**, 36-8 (1950).

C. A., **45**, 10119b (1951).

Variations in the elec. supply are responsible for fluctuation in photographic blackness; mean errors produced by these variations were detd. by an elec.-potential stabilizer. For Al-Fe alloys a chart was constructed, from detns. on standard samples, by means of which the use of the standard in subsequent analyses can be eliminated.

3495. MUSA, S.

II. Determination of Beryllium by the Liquid-condensed-sparking Method.

Science Repts. Research Insts. Tōhoku Univ., Ser. A, **2**, 39-42 (1950).

C. A., **45**, 10119c (1951).

A micromethod for detn. of Be in large quantities of Al and Cu is described. An electrode for samples in soln. consists of an iron cylinder 5 cm. in diam. and 2.4 cm. high, fitted with a Pt cover. Cd was used as a coupling electrode and Ca as an internal

standard. An analysis was also made without an internal standard. The results are accurate to within 4.5% and 7.3% for the two methods, resp.

3496. MUSA, S.

Quantitative Emission Spectrum Analysis.

III. Analysis of Boron by the Solution Method.

Science Repts. Research Insts., Tōhoku Univ., Ser. A, **2**, 437-42 (1950).

C. A., **46**, 3449c (1952).

A new type liquid electrode is used. For solns. of 0.015-0.15% B concn., the accuracy is $\pm 4.36\%$, by using the line pair B 2497.7 Å / Zn 2502.0 Å with Zn as an internal standard.

3497. MUSA, S.

Quantitative Emission Spectrum Analysis.

IV. Determination of the Silica-lime Ratio in Basic Slag.

Science Repts. Research Insts. Tōhoku Univ., Ser. A, **2**, 741-7 (1950) (in English).

C. A., **46**, 4416i (1952).

Cf. *C. A.*, **46**, 3449c. The log of CaO/SiO₂ from a calibration curve is more quickly detd. than is the quantity of each when the spectrum method is used. The app. has been described (Nippon Kinzoku Gakkai-Shi (*J. Japan Institute of Metals*), **12** (2-3), 37 (1948)). The test materials are prepd. by heating the sample, 1.5 hr. at 900°, grinding to a fine powder, and passing through an 80-mesh Cu sieve. A 6 × 8-mm. Cu cylinder with a concave upper surface of 4-mm. curvature radius and a brass 2.8 × 50 mm. rod fastened to the bottom was used as the electrode. Spread the powd. sample uniformly on the concave surface of the electrode and place a similar electrode opposite at a distance of 2.5 mm. Make a 30-sec. exposure with no preliminary discharge. The surface of the electrodes must be polished after each discharge. For rapid treatment after fixing, wash the plate for 1 min., dip in MeOH for 1 min., and dry at 40-5° for 2-3 min. The line pair chosen is Ca 4318.7 Å (1)/Si 2881.6 Å (1). The calibration curve is plotted for log of the ratio of the blacknesses of this line pair vs. log (CaO/SiO₂). The time (min.) required for taking the photographs of 3 standards and 4 test materials on one plate (7), development (3), fixing (3), washing (1), MeOH treatment (1), drying (3), measurement of blackness (15-20), calcns. (15-20) is less than 1 hr. Values of CaO/SiO₂ from 2 to 4 are detd. by this spectrum analysis agreeing within 10% with results by chem. analysis.

3498. NACHTRIEB, N.

Principles and Practice of Spectrochemical Analysis.

New York: McGraw-Hill Book Co. (1950).

Reviewed in *Anal. Chem.*, **22**, 1577 (1950) by J. Cholak: This book is divided into two parts. Part I gives in nine well written chapters the principles and the equipment involved in the application of emission spectrography to chemical analysis. Part II discusses the practice of spectrochemical analysis (qualitative and quantitative) in the metallurgical field including refractory materials and the analysis of solutions and finishes, with a discussion of chemical separations in spectrochemical analysis.

The value of the book lies in its suitability as a textbook rather than as a reference source on the application of emission spectrography to chemical analysis. Chemists who wish to familiarize themselves with the general fundamentals and the possibilities of spectrochemical analysis will find the book excellent for this purpose. Practicing spectrographers, on the other hand, will find in it little information not already given by existing books on the subject.

The discussions of the practical aspects of chemical spectroscopy are given chiefly from the viewpoint of the metallurgical field and the reviewer feels that the book contains little helpful information for those interested in studies of trace elements in the fields of medicine, toxicology, industrial hygiene, and, except for the flame methods, in studies of plant and soil problems. Although some very important studies on lead, antimony, and beryllium among others have been successfully carried out in the above fields by the use of emission spectrography, no mention is made of this work. Another oversight is the failure to refer to Feldman's porous cup method of excitation. This significant American contribution to excitation sources should not have been omitted in any book supposedly written to record the more recent advances in emission spectrochemical analysis.

3499. NATELSON, S.

Routine Use of the Perkin-Elmer Flame Photometer in the Clinical Laboratory. *Am. J. Clin. Path.*, **20**, 463-72 (1950). *C. A.*, **44**, 6907b (1950).

Na and K can be estd. readily with the flame photometer with an error of 2.5 and 2.0%, resp. The following precautions are necessary: Wash the burner daily with distd. water. Keep the flame large to minimize the cooling effect of the material sprayed into it. Compare the unknown to standards directly not to a standard curve which is variable. The atomizer must have a wide orifice, and it must not be moved during a series of detns. The meter must be read slowly as it does not respond promptly.

3500. NEKRASOV, B. Y., AND KOROVNIK, Z. V.

Spectrophotographic Determination of Copper in Duralumin.

Zavodskaya Lab., **16**, 883 (1950). *C. A.*, **45**, 973i (1951).

The detn. is made with the 2 line pairs: CuI 2824-Å I 2652 and Cu I 2824-Å I 2660 Å and the Al 3050 line as reference.

3501. NEVBU, N.

Spectrographic Determination of Thallium in Animal Tissues.

Ann. pharm. franç., **8**, 214-16 (1950). *C. A.*, **44**, 7372e (1950).

Digest the tissue with H_2SO_4 - HNO_3 , evap., treat the residue with Br, remove the Br by heating, and dissolve in 10 cc. H_2O . Mix 0.5 cc. with 0.5 cc. of a soln. contg. 0.5 mg. Cd. Place in a small Pt dish with a Pt wick, and produce an elec. spark between wick and a Pt electrode. Compare spectrographically with standard Tl solns. If P is present, which interferes with the spectrography, neutralize with NH_3 and add 0.05 g. Zn dust. After 1 hr. the Tl is deposited on the Zn and may be detd.

3502. NIKITINA, O. I.

Results of the Work of the Ukrainian Institute of Metals Regarding Technical and Methodical Help to Spectral Laboratories of the Southern Plants.

Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., **14**, 606-10 (1950).

C. A., **45**, 6954h (1951).

(1) Low-alloyed steels were analyzed for Si, Mn, Cr, Ni, in an a.-c. arc discharge, in a high-voltage spark, in a high-voltage spark with increased capacitance and in a spark superposed on an arc. Working curves are given, and the av. errors indicated. (2) Cast Fe has been analyzed for C, Si, Mn (av. quantities C 3.3, Mn 0.84, Si 2.2%). Working curves and errors are indicated for a spark discharge. (3) It is shown that Cr (4.08-25.79%), V (0.06-1.86%), W (2.74-18.56%) do not mutually influence one another in the exam. of highly alloyed steels.

3503. NORMAN, D. P.

Spectrographic Examination of Organic Materials.

U. S. Patent 2,509,649, May 30, 1950.

C. A., **44**, 8778a (1950).

Org. compds. and mol. aggregates, including high polymers and natural and synthetic macromols., can be dissoc. into mol. and polyatomic fragments by the action of an elec. discharge in an evacuated tube. The fragments are introduced into the pos. column of a glow discharge, and the emission and absorption spectra so reduced are observed with a suitable spectrograph. The solid or liquid sample is usually supported on

2 cups which are the ends of the 2 electrodes; the latter are in an a.-c. circuit of 500–25,000 v. and 0.1–1 amp.; the pressure in the discharge tube is preferably kept at 0.1–2 mm. In addn. to detn. of chem. compn., variation in chem. and phys. state within the mol., and the past history or treatment of the material can be ascertained either from the spectrum or from the potentials within the discharge or required to initiate the discharge. Examples of information obtainable by the technic include: variation in spectra of cotton samples with degree of mercerization, of urea-HCHO plastics and resins with differences in curing, and of rayon fibers with degree and manner of aging, and of discharge characteristics with variation in charge and distribution of charge on the mol. in a series of closely related, complex org. molecules.

3504. ÖDMAN, O. H.

Manganese Mineralization in the Ultevis District, Jokkmokk, North Sweden. II. Mineralogical Notes.

Sveriges Geol. Undersökn. Årsbok, 44, No. 2; Ser. C, No. 516, 1–28 (1950) (in English); *C. A.*, 45, 2823i (1951).

Analyses and optical data are given for various minerals.

3505. OERTEL, A. C.

Background Correction in Spectrochemical Analysis and Effects of Scattered Light in the Densitometer.

Australian J. Appl. Sci., 1, 152–63 (1950). *C. A.*, 45, 1457g (1951).

Scattered light in the densitometer causes serious errors in plate calibration curves (d.-log relative exposure) prepd. from readings made on a line or on line plus background in stepped spectrograms. Curves prepd. from readings made on the stepped background are satisfactory. Such curves can be used in a test of the method of background correction by deduction as an exposure. Measurements on a Mo line on 330 spectrograms from 125 plant ash samples gave Mo concns. agreeing very closely with chem. detns. Where background d. is less than 0.1, the correction may sometimes be made by deduction as a d. without loss of accuracy. One method of correction should be used for all samples and standards in any lot of analyses, since corrected line intensities by the 2 methods may be different.

3506. OERTEL, A. C.

Accuracy of a Spectrochemical (Arc) Method of Analyzing Plant Ash for Molybdenum and Copper.

Australian J. Applied Sci., 1, 259–69 (1950). *C. A.*, 45, 3286b (1951).

The accuracy with which Mo and Cu in plant material can be detd. by a simple spec-

trochem. method was examd. statistically. D.-c. arc excitation of the sulfated ash was used, with the sample in the anode and no internal standard. The correlation coeff. of spectrochem. and chem. detns. of Mo, in 125 samples contg. 0.01–15 ppm. of Mo, was 0.99; for Cu, in 134 samples contg. 2–20 ppm. Cu, it was 0.93. Errors in the spectrochem. and chem. methods resp., were of similar magnitude. Small variations in the wt. of sample used in the anode did not significantly affect the accuracy of detns. Internal standards were found unnecessary; external standards (iron oxide spectrograms) improved accuracy but not commensurately with the extra work. The d.-c. arc was a satisfactory source for accurate detns.

3507. OHOTO, Y.

Spectrographic Determination of Magnesium in Nodular Graphitic Cast Iron.

Repts. Osaka Pref. Ind. Research Inst., 2, 86–7 (1950).

C. A., 46, 11027c (1952).

Cast iron was dissolved in aqua regia and placed in preheated C electrodes between which a spark discharge was passed in a standard circuit. From the spectrogram of the spark compared with 7 standard spectrograms prepd. under the same conditions with cast Fe contg. known quantities of Mg.

3508. ORSAG, J.

A Direct-reading Spectrographic Equipment.

Congr. groupe. avance. method. anal. spectrograph. produits mét., 13, 61–73 (1950); cf. *C. A.*, 43, 5666h.

The apparatus consists of a Durr spark generator, an electrode holder permitting rapid exchange of electrodes facing a graphite counter electrode, a Zélande spectrograph, and two electron-multiplier phototubes one of which is fixed to receive light from an internal standard while the other is movable along the focal plane to receive in succession light from the different elements to be determined. With this instrument alloys of Duralumin type can be analyzed for Fe, Si, Cu, Mn, Mg, in 2 minutes with a standard deviation of about $\pm 1.5\%$ which is almost entirely due to the heterogeneity of the samples studied.

3509. PARISOT, J.

Carbons for Spectrography.

Congr. groupe. avance. method. anal. spectrograph. produits mét., 13, 41–2 (1950).

Burned carbon generally yields from 0.1 to 0.4% ash. The purest carbons, which are graphitized electrically, rarely contain less than 0.1% ash and the presence of so much mineral matter prohibits spectrographic use. Carbon rods, 7 × 120 mm., containing less

than 0.01% ash are made and tested by Carbone Lorraine. Spectrographic comparison of this carbon with an imported carbon shows the *raies ultimes* of B, Si, Al, Mn, Ca, V, Fe, sensibly the same in both, but Lorraine carbon has less Cu and more Mg than the imported.

3510. PARISOT, J., AND BADOZ

Carbons for Spectrography.

Colloque intern. Spectrographie Strasbourg, Oct., 1950, 57-60.

C. A., 46, 5973g (1952).

Commercial carbons, even the "electrographites," contain impurities in larger quantities than can be tolerated in analytical spectroscopy. The authors announce the properties of their pure carbons, Nos. 207 and 208. The first gives an ash content of less than 10^{-4} (0.01%) but these carbons are adequate for general work. Carbon No. 208 will satisfy more exacting requirements. Its ash content is so low that it is not measurable.

3511. PEARSE, R. W. B. AND GAYDON, A. G.

The Identification of Molecular Spectra, 2nd Ed.

John Wiley & Sons, Inc., New York (1950), 276 pp.

This is a revised edition of the useful book which first appeared in 1941. It provides tables of persistent band heads, individual band systems, practical limits on observing and identifying band heads, and illustrations of prominent band systems. Reviewed in *Spectrochim. Acta*, 4, 427 (1951).

3512. PERRY, V. G., WEDDELL, W. M., AND WRIGHT, E. R.

Multipurpose Method of Spectrographic Analysis.

Anal. Chem., 22, 1516-18 (1950).

C. A., 45, 2813d (1951).

Samples, after chem. prepn. when necessary are converted into 20% aq. NaNO_3 solns. A drop of soln., contg. 1 mg. of Na_2MoO_4 per ml. as internal standard is evapd. on the ends of pairs of kerosene-impregnated graphite electrodes. The electrodes are excited with a 2.2-amp., 2200-v., a.-c. arc for 30 sec. Conventional methods of plate calibration and of prepn. of standards and working curves are employed. Forty-two elements have been detd. with av. deviations within 5%. The accuracy is also satisfactory, as judged by comparison with chemical detns. Applications are cited for the detn. of elements in Na salts, org. substances, materials sol. in HNO_3 , and certain refractories.

3513. PETERSON, G. E., WELFORD, G. A., AND HARLEY, J. H.

Spectrographic Microdetermination of Beryllium in Air Dust Samples.

Anal. Chem., 22, 1197-1200 (1950).

C. A., 45, 1457i (1951).

An adequate method for detg. Be in air must measure at the level of 0.001 γ per cu. m. From 100 to 20,000 cu. m. of air is drawn through "type S" unimpregnated filter papers at about 2 cu. m./min. The filter is macerated with HNO_3 , wet-ashed with H_2SO_4 plus HClO_4 and the soln. is taken to dryness in Pt after addn. of HF. The residue is taken up in HCl and Fe, Al, and other metals are pptd. with oxine in a buffered acetate soln. Excess oxine is extd. with CHCl_3 and Be is pptd. as hydroxide on 2.5 mg. of Al as carrier. The ppt. is collected (centrifuge tube), dissolved in H_2SO_4 , and the vol. adjusted to 1 ml. of 4.5 N acid. Aliquots are dried in C electrodes contg. about 45 mg. NaCl and arced (d.c., 10 amp., 2 min.). Be is estd. from triplicate density ratios Be 2349/Al 2367 or Be 2651/Al 2367. The first ratio gives a standard line from 0.005 to 0.2 γ ; the second, from 0.1 to 10 γ Be on the electrode. The spectrographic method is accurate to $\pm 20\%$ and the efficiency of the chem. procedure is about 90%.

3514. PETERSON, M. J.

Spectrochemical Determination of Iron, Magnesium, and Manganese in Titanium Metal.

Anal. Chem., 22, 1398-1400 (1950).

C. A., 45, 1907d (1951).

A H_2SO_4 soln. of Ti is placed in a porous-cup electrode (*C. A.*, 43, 8945b) and excited with a Multisource. Standard deviations for Mg (3-sec. exposure), Fe and Mn (30-sec. exposure) were 6.8, 7.6, and 6.7% of the value obtained in the 0.02-0.5% concn. range. Spectrochem. values agreed to within 5-7% with wet chem. values.

3515. PREILSTICKER, K.

The Simultaneous Spectrochemical Determination of Sodium, Potassium, Calcium, Magnesium, and Phosphorus in Blood Serum or Ash.

Spectrochim. Acta, 4, 100-15 (1950).

C. A., 44, 10776c (1950).

A method of direct spectrochem. analysis of serum using a low-voltage spark is described, which gives sufficient sensitivity for the elements Na, K, Ca, Mg, and P. The precision is in the range 3.4 to 4.3%, as estd. by the standard deviation of a series of tests, and the sample vol. need only be 0.5 ml. or in special cases 0.1 ml. The method is calibrated by synthetic standard samples; errors are avoided by imitating the org. contents of the serum with a condensation product of glucose, urea, and glycine. This also improves the smoothness of sparking.

The effect of various sources of error, such as changes in acidity or chloride content, is fully explored. Use of this condensation product facilitates other analyses of fluids and powders on nonporous plane electrodes.

3516. PIERUCCINI, R.

Distribution of Boron in Petroleum-bearing Clays of Piacenza; Spectrographic Determination Methods, Geochemical Discussions.

Periodico mineral. (Rome), 19, 209-38 (1950).

C. A., 45, 3777c (1951).

The spectrographic detn. of B in sedimentary rocks, etc., is considerably improved by the introduction of a high-frequency intermittent arc device, in the place of d.-c. arc, with Cu rods as electrodes. A newly constructed generator equipment with Tesla transformer, rotary interrupter in a Feussner-Zeiss type circuit is described in detail. It is similar to that used by Pfeilsticker (*Z. Elektrochem.*, 43, 719-21 (1937)). B was detd. spectrographically in a series of clays from bore holes of Podenzano and S. Giorgio province of Piacenza) by using a standard mix of 60% SiO₂, 20% Al₂O₃, 1% Fe₂O₃, 6% MgO, 10% CaCO₃, and 3% Sb₂O₃, for a comparison of the lines B 2497.73 Å and 2496.77 Å with 6 neighboring Sb lines. The spectrograms were evaluated with a photoelec. photometer, and galvanometer reading. Seven samples of Middle Miocene age gave on the av. 0.061% B₂O₃; 5 samples of Upper Miocene age: 0.078%; 7 samples of Pliocene clays: 0.11%. After deduction of CO₂ (from the calcite content of the sediments) the results are 0.13, 0.13, 0.15%, resp. The marine origin of these sediments here expresses a remarkably const. B concn. in the sea water from which they originated. An elaborate discussion is presented of the observed facts in comparison with Goldschmidt's (*C. A.*, 28, 2648^b) and Landergren's (*C. A.*, 40, 6373^a) previous geochem. studies.

3517. PIERUCCINI, R.

A Sensitive Method for the Spectral Detection and the Determination of Arsenic by Means of Adsorption in Ferric Hydroxide.

Spectrochim. Acta, 4, 189-99 (1950).

C. A., 45, 2364e (1951).

For the estn. of As in very dil. solns. use is made of the facility with which Fe(OH)₃ adsorbs As from solns. Arsenic free FeCl₃ is added to the soln. followed by pptn. with NH₄OH and soln. of the ppt. in dil. acid. This soln. is absorbed by C electrodes and tested spectrographically with a condensed spark and quartz spectrograph. The sensitive As I lines 2348.8 and 2288.1 Å are compared with Fe I lines 2287.25, 2290.54,

2294.61, 2297.79, 2309.00, and 2320.36 Å. The method is applicable to 0.1 mg. As in 24.1 of soln., and can be used to test the freedom of reagents from this element. It can also be applied to the estn. of As in org. substances, if the oxidation is performed under controlled conditions. The widely distributed Fe in weathered minerals yields sufficient Fe(OH)₃ to act as a dispersing medium for the As in the lithosphere.

3518. POTGIETER, J. E.

A Spectrochemical Method for the Determination of Potassium in Organic and Biological Materials.

Union S. Africa Dept. Agr. Sci., Bull. No. 312, 10 pp. (1950).

C. A., 45, 8937b (1951).

A spectrochem. method for detg. K is described by using the method of internal standards combined with the microphotometric detn. of line ds. The org. samples are first ashed, the resulting C-free material is treated with HNO₃ and then dissolved in a spectroscopic buffer to which Mo is added as an internal standard. Aliquots of the test soln. are dried on purified graphite electrodes and arced in a high-voltage a.-c. arc.

3519. PREUSS, E.

Spectral Identification of Thallium.

Biochem. Z., 320, 258-68 (1950).

C. A., 44, 7183h (1950).

An investigation of the detection of thallium by the Mannkopf-Peters' method.

3520. PREUSS, E. AND GLISZCZYNSKI, S. v.

Beryllium Content of Several Wavellites.

Geochim. et Cosmochim. Acta, 1, 86-8 (1950) (in German).

C. A., 46, 3463i (1952).

Wavellites and several other phosphate minerals from a number of locations have been spectroscopically examd. While the assocn. of Be with Al is expected, an at. ratio of Be:Al as high as 1:20 as compared to 1:5000 as reported by Goldschmidt (*Geochemische Verteilungsgesetze. IX. Mengenverhältnisse der Elemente und der Atomarten*, 1938, p. 120 (*C. A.*, 32, 7376^a)) is unexpected. Cr was found in a few samples, but is in low concn. V was also found in a few samples. Cr assocd. with the V is thought to act as a phosphor. The investigation showed three types of these minerals, i.e., high Be (0.3-1%), high V (0.01-0.1%), and low Be (about 0.01%) and equiv. low or no V content.

3521. PRILEZHAEVA, N. A. AND GORYACHEV, V. N.

Determination of the Concentration of Sodium Atoms in the Positive Column of an Arc Discharge.

Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., 14, 732-6 (1950).

C. A., 45, 4131b (1951).

If one component of the gas has a much smaller ionization potential than the other and is present in a small concn., Saha's equation can be simplified and the concn. of this component can be calcd. from the av. ionization and the temp. These quantities were detd. on Ba lines Ba II 4900 and 4939 Å and Ba I 4726 Å, since Ba has a similar ionization to Na and does not show reabsorption. The electrode consisted of 10-50% NaCl (or 2-30% Na borate glass), 1% BaSO₄, and the remainder C powder. The concn. of Na atoms in the vapor is proportional to the amt. in the electrodes and it is higher for the NaCl than for Na borate glass. The concn. of the Na vapor is equal to 0.5-4% of the total amt. of gas in the arc.

3522. PROEHL, E. C. AND NELSON, W. P.

The Flame Photometer in Determinations of Sodium and Potassium.

Am. J. Clin. Path., 20, 806-13 (1950).

C. A., 44, 10779b (1950).

Details are given for obtaining specimens, techniques of operation, and a method of overcoming the effects of Na on K is given. The interference of viscosity, urea, phosphate, and glucose can be overcome by appropriate diln.

3523. PROKOF'EV, V. K.

Utilization of the Spectral Background in the Quantitative Spectral Analysis of Small Concentrations of Impurities.

Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., 14, 660-4 (1950).

C. A., 45, 6955i (1951).

The influence of the background in the analysis of small amts. of Cu in Al alloys was studied. It is shown that the amt. of background is const. for different concns. of Cu and that the exclusion of its intensity in the working curves would lead to a steeper curve. The intensity of the background depends very much on the size of the slit. The const. background around line Cu 3273.96 can be used as an interior standard for prep. working curves.

3524. REED, A. C.

Spectrographic Analyses for Vanadium in Kansas Clays.

Kansas Geol. Survey Bull. No. 86, 21-40 (1950).

C. A., 46, 2974b (1952).

The prepn. of standards is described. Clays were leached for varying periods to obtain standards of const. background compn. with varying V contents. Fe was used as

internal standard. Analyses showed 0.022 to 0.144% V₂O₅ in 13 clays.

3525. RICHTER, A. E., SCARTH, J. C. AND BERNHARDT, A. A.

The Use and Application of Flame Spectrophotometry in Alkaline Pulp Mill Control.

Pulp and Paper Mag., Canada, 51, 153-5, and 158 (1950).

Spectrochim. Acta, 4, 313 (1951).

The application of the Beckman DU spectrophotometer with flame attachment to the determination of sodium and calcium in paper pulp and sewage effluents is described. Sewage effluents are prepared for analysis by diluting twenty-five times with water, adding hydrochloric acid if a turbidity appears, and filtering about 5 ml. of this if there is still visible suspended matter. For the determination of sodium in paper pulp slurry from brownstock washers, the sample is diluted with water, filtered by suction through fritted glass, washed with distilled water, and the filtrate used for the analysis. A correction is made for a constant amount of sodium left in the filter cake. For the determination of calcium in the pulp, a water filtrate is prepared in a similar manner to that used for the determination of sodium. At this stage another filtrate is obtained by washing the filter cake with hydrochloric acid and water. The water and acid filtrates are kept separate to prevent precipitation of lignin and the final calcium content derived by adding the calcium content of both filtrates. In operation, sodium is determined first in all the samples, then the instrument settings are changed and the calcium is determined. The advantages of the use of the flame photometer are discussed, among these being the rapidity with which the analysis can be carried out, this permitting, for example, the tracing of losses of sodium and calcium in the sewage effluents.

3526. RICHTER-BERNBURG, G.

Facies, Tectonics, and Copper Content of the Zechstein in Two Areas: Waldeck and Northern Sudeten.

Geol. Jahrb. Reichsanst. Bodenforsch., 65, 145-212 (1950).

C. A., 45, 5578g (1951).

The paleogeography of the Zechstein Ocean is discussed, with analyses for the Cu and Pb content of many sedimentary rocks. The highest amts. of Cu are in sediments deposited in quiet nearshore waters.

3527. RILEY, R. V.

Routine Spectrographic Analysis of Cast Iron.

Spectrochim. Acta, 4, 93-9 (1950).

C. A., 44, 10580a (1950).

Minor changes have been made in the technique described before (*C. A.*, **40**, 6364²) and the method of analysis is here reviewed in the light of experiences over five years. For routine chem. analysis of the minor metallic constituents and Si in cast iron, spark testing on chill-cast samples has been found sufficient. The exptl. conditions are described in detail and the wave lengths employed in the detn. of Si, Mn, Ni, Cr, Cu, Sn, Mo and V are tabulated together with ranges of concn. between 0.02 and 4.00%. The errors are less than $\pm 2.5\%$ of the content of the element being detd.

3528. ROBINSON, A. R., NEWMAN, K. J., AND SCHOEB, E. J.

Mineral Analysis of Biological Material by Flame Spectroscopy. Apparatus and Application.

Anal. Chem., **22**, 1026-8 (1950).

C. A., **44**, 10772e (1950).

A burner is described for use with a Bausch and Lomb medium quartz spectrograph for detg. 15 elements in biol. material. Reproducibility to 5% is claimed.

3529. ROLLWAGEN, W.

Phenomena of Temperature Excitation in the Carbon Arc.

Colloque intern. spectrographie Strasbourg, Oct., 1950, 145-7.

C. A., **46**, 5961i (1952).

Expts. with 4-amp. d.-c. arcs between C electrodes show that variable amts. of Na (from 0 γ to 525 γ) change the temp. of the arc and that traces (1 to 10 γ) of metals added to the anode are excited to a max. value at a certain concn. of Na, provided the metals have higher ionization potential than Na. No max. was observed for elements having ionization potentials near that of C; for these line intensity falls off with increasing Na.

3530. RONNIE, E. J. AND HALLETT, H. M.

Spectrographic Analysis in the Gray-iron Foundry.

Foundry Trade J., **89**, 115-23 (1950).

Proc. Inst. Brit. Foundrymen, **43**, A77-86 (1950).

C. A., **44**, 10594c (1950).

A general discussion of the applicability of spectrographic analysis to foundry work. Procedures are given also for the analysis of irons.

3531. ROSEN, B. AND OTTELET, I.

Use of the Hollow Cathode and the Vacuum Furnace in Spectroanalysis.

Colloque intern. Spectrographie Strasbourg, Oct., 1950, 155-67.

C. A., **46**, 6029e (1952)

A thin-walled hollow cathode of graphite heated to 2500°C. by a discharge through a

rare gas such as A, proves to be an excellent source for the spectrochem. analysis of very small samples. The lines of the alloying elements and impurities appear in succession with increase in temp. and pressure of the inert gas. This source is of use also in studying occluded gases, such as O, which unites with the C of the cathode and emits the CO bands. Similar results for metals and alloys may be obtained with a graphite tube vacuum furnace which can be heated up to 2500°C. The occluded gases are studied by means of their absorption spectra.

3532. ROUSE, A. G.

A New Source for Spectrochemical Analysis.

J. Optical Soc. Am., **40**, 82-4 (1950).

C. A., **44**, 3395e (1950).

An induction heater is used to evap. the sample held in a C cup, and the vapor is then excited by a spark. The 2 main functions of a source, evapn. and excitation, are thus controlled separately. Measurement of the b.p. can serve to differentiate elements and compds.

3533. ROUX, E. AND HUSSON, C.

Method of Spectrographic Analysis of Copper.

Ann. agron., **1**, 494-6 (1950).

C. A., **45**, 2816i (1951).

The old method of combining Cu with dialkyl thiosulfocarbamic acids is replaced by a spectrochem. method. 0.5 mg. Cu/l. can be detected.

3534. ROUX, E. AND HUSSON, C.

Spectrographic Analysis of Boron.

Compt. rend., **230**, 1068-70 (1950).

C. A., **44**, 6341d (1950).

B is detd. spectrographically with the 2497.7 Å line and the elec. arc. The cathode is a rod of electrolytic Cu about 10 cm. long by 4 mm. diam. A hole 4 mm. in diam. and 3 mm. deep is drilled into it. It is placed horizontally with its axis passing through the window of the spectrograph. The anode is in the same plane, placed vertically and 2 mm. below the cathode. It also is of Cu in sheet form, 2 mm. thick and 5 mm. wide. Each pair of electrodes is used only once. The B is present as H₂BO₃ in a soln. which is dried on the cathode. Standard samples are arced and a curve is made relating concn. to blackening as measured by a microphotometer.

3535. ROUX, E. AND HUSSON, C.

Elimination of Errors Due to Variations of the Continuous Background in Quantitative Spectrography.

Compt. rend., **231**, 770-2 (1950).

C. A., **45**, 1870i (1951).

Reference spectra, in which an artificial background is introduced by superposition of the H arc continuum, make possible calcn. of actual arc line intensities.

3536. RUDNEVSKIĬ, N. K.

The Influence of Silicon on the Intensity of Aluminum Lines in the Analysis of an Aluminum-silicon Alloy in an Alternating-current Arc.

Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., **14**, 642-7 (1950).

C. A., **45**, 7464h (1951).

In an a.-c. arc the abs. intensity of the arc lines Al I 2660.39, 2652.49, and 2567.99 Å increases with increasing Si concn. in a binary AlSi alloy, although the Al concn. decreases. The change in intensity of non-homologous Al line pairs with increasing Si concn. indicates a change in the arc temp. Si lowers the temp.; expts. show that the amt. of volatilized alloy increases with increasing Si concn. In a condensed spark discharge, which has a higher arc temp., there is no change in line intensity with increasing Si content.

3537. RUDNEVSKIĬ, N. K., IVAGINA, P. N., AND IVAGIN, P. N.

Spectral Determination of Calcium in Aluminum-ammonium Alums.

Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., **14**, 698-700 (1950).

C. A., **45**, 7466c (1951).

The method for detg. Mg in alums (*C. A.*, **45**, 7466b (1951)) is used for detg. Ca in alums in a 10% alum soln. Concns. of $8 \times 10^{-4}\%$ Ca could be detd. with the line pair Ca II 3933.67-Al 3057.15 Å. A method of graphic approximation is indicated for the construction of working curves.

3538. RUSSELL, H. N.

The Arc and Spark Spectra of Gadolinium.

J. Optical Soc. Am., **40**, 550-75 (1950).

C. A., **44**, 10497i (1950).

Analyses based on wave nos. and intensities have led to the classification of 1177 lines of Gd II and 1217 lines of Gd I. The percentages of the stronger lines which have been classified are, resp. 77 and 90; of all observed lines 45 and 40. Almost all lines of astrophys. interest are included. All the identifiable terms are derived from the ground state $^4S^0$ of trebly ionized Gd. The principal low terms of Gd II come from the electron configurations $4f^7 5d^2$, $4p^1 5d 6s$ and $4f^7 6s^2$, those of Gd I from $4f^7 5d 6s^2$ and $4f^7 5d^2 6s$. Terms of multiplicity 6, 8, and 10 are recognized in Gd II, and 7, 9, and 11 in Gd I. The multiplets are remarkably regular, and the intersystem combinations are numerous and strong. Rydberg formulas applied to Gd I terms in series lead to an ionization

potential of 6.16 e.v. Series terms could not be found in Gd II, but it is estd. that the second ionization potential is 12 to 13 e.v.

3539. RUSSELL, R. G.

Spectrochemical Analysis of Brines.

Anal. Chem., **22**, 904-7 (1950).

C. A., **44**, 9886g.

A spectroanalytical procedure for brines is presented which comprises a qual. and quant. part. Conditions are described for the detn. of B, Bi, Fe, Al, K, Ba, Sr, Ca, Na, and Mg. The brine is evapd. to dryness with HCl and all the major constituents are then assumed to be chlorides. An a.-c. spark is used for excitation. Standard working curves are drawn by using the relative standard method.

3540. RUVINSKAYA, R. V.

Spectroscopic Determination of Arsenic in Lead Oxide.

Zavodskaya Lab., **16**, 106-7 (1950).

C. A., **44**, 6762b (1950).

The use of an a.-c. arc excitation permits the approx. detn. of 0.0001-0.0006% concns. of As, by means of the 2349.84 Å line of As.

3541. SALMI, M.

Trace Elements in Peat.

Geol. tutkimuslaitos, Geotek. julkaisuja, **51**, 20 pp. (1950) (English summary).

C. A., **45**, 6976i (1951).

The peat bogs act as collectors of trace elements. The occurrence of Cu, Zn, Cd, Sn, Pb, Mn, Co, and Ni in peat ashes is discussed on the basis of analyses of peat samples collected from 49 bogs in Finland and one in Norway. The content of the 8 metals, detd. by semiquant. spectrochem. methods, the 63 peat-ash samples is presented, along with data showing the species of peat, degree of decay, pH, ash percentage, and the depth of the sample. The percentages vary as follows: Cu < 0.01-0.3, Zn < 0.03- > 1.0, Cd < 0.0003-0.003, Sn < 0.003-0.03, Pb < 0.001-0.1, Mn < 0.01-1.0, Co < 0.001-0.03, and Ni < 0.003-0.2. The content of Ga was 0.001-0.003% and that of Cr commonly < 0.01%. The data are discussed and it is concluded that the trace-element content of peat from different bogs displays marked variations. The following percentages in peat ashes probably are indicative of the presence of ore deposits in the neighborhood: 0.1 Cu, 0.6-1.0 Zn, and 0.06-0.1 Ni. The trace-element content does not materially depend on the botanical compn. of the peat; the effect of the degree of decay is still unsettled; the ash content has no decisive role; in samples of high pH the content of trace elements is usually lower than in those of lower pH; the content varies with the depth in the profile. The results show that the changes in the trace-element content of

peat reflect chiefly the compn. of mineral soil and bedrock in the neighborhood of the bogs. The role of peat and of peat ashes as fertilizer is attributable to their trace-element content. 11 references.

3542. SANCHEZ SERRANO, E. AND JIMENO MARTÍN, L.

Auxiliary Ionization in Spectrochemistry. II. By Flame.

Anales real soc. españ. fis. y quim., **46B**, 617-26 (1950).

C. A., **45**, 6049a (1951).

An ordinary gas flame introduced between the electrodes in a spark discharge increased reproducibly the no. and intensity of detectable lines, especially of minor constituents and notably of Pb and Sn. Two flames from metal tubes of 1 mm. internal diam. were directed symmetrically and normally near the lower electrode or between the 2, as near to the electrodes as possible without raising their temp. appreciably.

3543. SCHMIDT, R. AND WOUTMAN, F.

The Suppression of the Cyanogen Bands in the Spectra of Graphite.

Congr. groupe. avance. méthod anal. spectrograph. produits mét., **13**, 163-5 (1950).

C. A., **45**, 8871a (1951).

Cyanogen bands in the spectrum of graphite can be suppressed by making arcs burn in oxygen.

3544. SCHÖNTAG, A. AND CAMERER, L.

Effect of Atmospheric Pressure on the Intensity Ratio of Two Spectral Lines and on the Quantitative Spectrochemical Analysis of Alloys.

Z. wiss. Photogr., **45**, 173-84 (1950).

Spectrochim. Acta, **4**, 413 (1951).

Measurements in a pressure range of 100-840 mm. Hg show that the intensity ratios of analysis lines excited in spark discharges are affected by atmospheric pressure. The FF and the so-called Resonance spark give a different dependence; the physical causes of this are indicated.

3545. SCHRADER, G.

The Quantitative Lead Determination in Drinking Water and Blood.

Z. Hyg. Infektionskrankh. **131**, 636-40 (1950).

Klin. Wochschr., **28**, 759 (1950).

C. A., **45**, 2533i (1951).

By using a d.-c. arc instead of a spark the sensitivity for the spectroscopic Pb detn. was increased 50-fold. A quartz spectrograph with large dispersion was used. It was found that values below 100 γ Pb/100 cc. blood are normal and those above 300 γ Pb/100 cc. blood are pathol. even without clinical symptoms.

3546. SCHRENK, W. G. AND SMITH, F. M.

Flame Photometer Attachment as an Excitation Source for the Spectrograph.

Anal. Chem., **22**, 1023-6 (1950).

C. A., **44**, 10488f (1950).

The flame attachment of the Beckman spectrophotometer was used as the excitation source in conjunction with a Bausch and Lomb large Littrow spectrograph for the lines of Na 5890 and 5895.9 Å; K 7664.9 and 7699.0 Å; Li 6707.8 Å and Ca 4226.7 Å. (The plate used, Eastment I-N, is not optimum for this Ca line.) The attachment was adapted by means of a special mirror and lens. Slit width was set at 45 μ and exposure time was standardized at 30 sec. Line intensities were measured with an A R L-Dietert densitometer. Standard curves range up to 100 ppm. for K and 400 ppm. for Na and are best prepd. with 100 ppm. Li as an internal standard. They are not straight; relative intensities plotted against concns. give regular curves. Optimum conditions of air, gas, and O₂ pressure are given for each metal. Org. samples must be previously ashed and taken up as chlorides. Results for K and Na on various plant and biol. materials compare well with those by chem. methods.

3546a. SCHROLL, E.

Trace-Element Paragenesis (Microparagenesis) of Sphalerites from the East Alps.

Österr. Akad. Wiss., Math.-naturw. Kl. Ans., **87**, 21-5 (1950).

C.A., **47**, 11083f (1953).

Spectrochem. detns. were made of the trace-element content in about 200 sphalerites for regional geochem. purposes. Semiquant. data are presented of the content of Ag, Cd, Ge, Ga, In, Tl, As, Fe, Mn, and Co in 41 sphalerites. The geographical distribution of these elements is discussed. Ga dominates in the samples investigated, while the content of In is low. Tl always accompanies As. The relations between the trace-element assemblage and temp. of formation of these sphalerites agree with those found in previous investigations. (cf. *C.A.* **47**, 5313b.)

3547. SCHÜLER, H.

Possibility of Applying the Hollow Cathode Discharge to Spectroanalytical Investigations.

Colloque intern. Spectrographie Strasbourg, Oct., 1950, 169-71.

C. A., **46**, 6029g (1952).

Advantages of using the cooled hollow cathode as a source for spectrochem. analysis are: reproducibility of all the exptl. conditions, such as gas pressure, current density, dimensions of parts, and uniform distribution of the analytical sample on the walls of the

cathode, with resultant constancy of brightness and illumination of the spectrograph slit. The source is particularly suited for analysis of the rare earths of which only minute samples are available as oxides. If the cathode walls are coated with the oxides the heat of the discharge reduces them and leaves the cathode plated with a metal surface from which the spectrum is emitted.

3548. SCHÜLER, H.

Emission Spectroscopy of Organic Substances with the Aid of Electron-impact Excitation in the Glow Discharge. I.

Spectrochim. Acta, 4, 85-92 (1950).

C. A., 44, 10505i (1950).

By use of a new type of discharge tube, in which the pos. column is observed at low temps. and with low excitation currents, it is possible to observe the spectra of org. mols. instead of the usual glow-discharge spectrum of mol. fragments. Resemblances and differences between the emission and absorption spectra of various benzene derivs. are discussed and the spectra of org. compounds with one ring are described to illustrate the subject. A change in the quinone spectrum in the presence of phenol has been observed and attributed to the presence of an H linkage.

3549. SCHÜLER, H. AND REINEBECK, L.

Method of Varying the Excitation Conditions of Organic Substances in the Glow Discharge.

Z. Naturforsch., 5a, 657-60 (1950).

C. A., 45, 6042e (1951).

New emission spectra of org. substances are obtained by the introduction of small varying amts. of evapd. compds. into the pos. column of a glow discharge; good results are found when the discharge passes initially through a noble gas. With increasing vapor pressure the electron velocity distribution in the discharge falls off, and the energy needed to excite an emission spectrum can be detd. With C_6H_6 evapd. in He, 4 new spectra were found.

3550. SCOTT, R. O.

The Effect of Electrode Dimensions on Spectral-line Intensity in the Carbon Arc.

Spectrochim. Acta, 4, 73-84 (1950).

C. A., 44, 10501b (1950).

Results for the spectrographic detn. of trace elements in an alumina matrix, obtained by carbon-arc excitation, are given for the variations in both trace element and internal standard line intensities and in the intensity ratios caused by relatively small variations of the cathode dimensions from the normal size of 2.8-mm. outside diam. and a boring 8 mm. deep and of 0.8-mm. diam. The elements considered are Co, Zr, Zn, Ti,

V, Mo, Sn, and Pb with Fe as the internal standard, and also Zn with Cd, and Pb with Bi as internal standards. The dimensions altered, firstly with const. sample weights in the electrode, include outside diam., depth of placement of the sample in the boring, and variation of the sample-to-carbon ratio in the boring; and secondly with variable weights of sample in the boring, depth and boring diam. It is shown that variation of the electrode dimensions can alter not only the line intensities but also the intensity ratios. The excitation of the elements would appear to be most seriously affected by any variable, such as the depth of the boring, which changes the relative rates of evapn. of the elements. Other factors, such as change in the elec. characteristics of the arc by increased sample weight appear in general to have much less effect. Accurate detns. of trace elements will be obtained only if the electrode dimensions and especially that of the electrode boring depth are kept const.

3551. SÉGUIN, M., AND GRAMME, L.

A Study of Qualitative and Quantitative Analytical Methods for Copper-beryllium Alloys. III. Emission Spectroscopy.

Bull. soc. chim. France, 1950, 388-400.

C. A., 44, 7185c (1950).

A review of qual. and quant. analysis by emission spectra, including methods used for Be and its alloys. A simplified, d.-c. arc spectrograph is described and its performance is tested with known Cu-Be alloys. Provided the instrument is adjusted to operate under optimum conditions, it is possible to det. Be as accurately as with more complicated equipment. 40 references.

3552. SEMENOVA, O. P. AND KOKHANENKO, V. V.

Mechanism of the Excitation of Spectral Lines in a Low-pressure Arc Discharge.

Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., 14, 727-31 (1950).

C. A., 45, 4130g (1951).

The validity limits of Boltzmann's law in low-pressure discharges were investigated. The intensities of the triplet lines Sr 4892 Å and Zn 3346 Å were compared with the intensities of the singlet lines Sr 5156 Å and Zn 6362 Å at different pressures. It is shown that the ratios $I_{\text{triplet}}/I_{\text{singlet}}$ are independent of pressure above $P = 10$ cm. Hg and drop at lower pressure, which is in agreement with the theory. Boltzmann's law is valid for ionized-state durations of 10^{-8} sec. down to pressures of 10 cm. Hg. The same conclusion was reached from electron temp. measurements of lines Zn 3072, 3076, and 3303 Å. Relative intensities of lines measured on Zn

3076, 3072, and 3303 and Cu 5105 and 5153 show a max. at 22 cm. Hg.

3553. SEVERINGHAUS, J. W. AND FERREBEE, J. W.

Calcium Determination by Flame Photometry. Methods for Serum, Urine, and Other Fluids.

J. Biol. Chem., 187, 621-30 (1950).

C. A., 45, 3451b (1951).

Serum is dild. 1:10 and the protein pptd. with CCl_3COOH . Other fluids are dild. so that the concn. of Ca is in the range of 0.1 to 1.0 milliequivs./l. Ca measurements are made with the Beckman quartz spectrophotometer with a flame attachment, and the intensity is measured at the 556 $\text{m}\mu$ CaO line. A correction for the effect of variations in Na and K concn. may be made. The method is accurate to within 1%.

3554. SHAVRIN, A. M.

The Dilution Method in the Spectral Analysis of Vanadium in Titanium Magnetite. *Izvest. Akad. Nauk S.S.S.R., Ser. Fiz.*, 14, 673-6 (1950).

C. A., 45, 6963e (1951).

V and Mo (as an internal standard) are mixed with SiO_2 as base material; V is introduced as $3\text{CuO} \cdot \text{V}_2\text{O}_5 \cdot 4\text{H}_2\text{O}$, Mo as $(\text{NH}_4)_6\text{Mo}_7\text{O}_{24} \cdot 4\text{H}_2\text{O}$. The intensity of the line pair V 3110.71-Mo 3112.12 was measured on mixt. $\text{SiO}_2 + 3\% \text{ Mo} + 0.4\% \text{ V}$, also contg. one of the following compds. Fe_2O_3 (50%), TiO_2 (15%), Al_2O_3 (10%), CaO (10%), MgO (10%). Only Fe_2O_3 decreases the intensity ratio; if the original sample is mixed with 4 parts of SiO_2 , satisfactory results should be obtained. Working curves are shown.

3555. SHAW, D. M., JOHNSON, O. I., AND AHRENS, L. H.

A Double-arc Method for Spectrochemical Analysis of Geological Materials.

Spectrochim. Acta, 4, 233-6 (1950).

C. A., 45, 2368d (1951).

Owing to the low concn. of several volatile elements (e. g., Tl, In, Pb, Sn) in geol. materials, ordinary d.-c. arc techniques usually fail to detect them. Combined chem. pre-enrichment and spectrochem. procedures are laborious and there is danger of contamination from chem. reagents. The sensitivity of the volatile elements is enhanced by fractionally distg. them into the arc. This is accomplished by a double-arc method in which the sample is arced with Li_2CO_3 in a miniature graphite furnace placed between the electrodes of a 7-amp. arc. In silicate rocks 0.05 ppm. Tl can be detected.

3556. SHERMAN, J.

Emission Spectrographv.

Physical Methods in Chemical Analysis, Vol. I, ed. by W. G. Berl, pp. 256-332 (1950).

Academic Press, New York.

Reviewed in *Spectrochem. Acta*, 4, 418 (1951) by J. H. Enns. The author's long experience in the field of applied spectroscopy is demonstrated by the careful arrangement of detail normally associated with this field. The fact that there are ten other chapters in the volume, dealing with as many different forms of spectroscopy, makes each chapter of necessity a highly condensed version of its own subject matter. Essentially the chapter is divided into six major parts, dealing with the spectrographic laboratory, spectrographs and densitometers, sources, samples preparation, photographic plate and analytical procedure. Of these, most extensively covered are the latter two. In the final section the author outlines in considerable detail a proposed standardized method for the routine analysis of steel.

3557. SHINAGAWA, M.

Recent Physical Methods in Chemical Analysis.

Kagaku no Ryōiki (J. Japan. Chem.), 4, 530-5 (1950) (In Japanese).

C. A., 45, 4597e (1951).

A review with 45 references, including brief references to emission spectrographic methods both photographic and photoelectric.

3558. SHIPITSIN, S. A.

Spectral Analysis of Biologic Materials.

Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., 14, 677-82 (1950).

C. A., 45, 7185i (1951).

To the ash of the sample are added graphite powder, an element stabilizing arc temp., and an interior standard element, and the mixt. is introduced in a d.-c. arc. Arc temps. were studied on the behavior of line pairs V I 3185.39-V II 3110.70 Å and Be I 3324.34-Be II 3131.07 Å, and the blackening of lines of Cr, V, Ag, Pb, and Sn was plotted against arc temp. CaO , tissue, bone, or NaCl as base give displaced working curves for Cr or Pb. A 3-phase a.-c. arc was also tried. The lower electrodes carrying the mixt. can be mounted on a disk rotated by a synchronous motor giving an impulse-type operation. This favors formation of oxides of metals such as W, Mo, V, Re. The 3-phase impulse a.c. arc gives greatly increased blackenings of the photographic plate.

3559. SHIRLEY, H. T., OLDFIELD, A. AND KITCHEN, H.

A Statistical Study of the Behaviour of Spectrographic Source Units.

J. Iron Steel Inst., 166, 329-38 (1950).

Spectrochim. Acta, 4, 414 (1951).

This study follows up previous work on the statistical examination of the magnitude and origin of variability in the analysis of low-alloy steel (see Shirley, H. T., Elliott, E., and Meeds, J., *J. Iron & Steel Inst.*, 157, 391-409 (1947)). Comparisons are made between various types of excitation units, particularly the Hilger ordinary uncontrolled high-voltage condensed spark unit and the Metro-Vickers controlled low-voltage source, and it is concluded that the various controlled units show no superiority over the simple uncontrolled spark unit. (Other units tested were the Metro-Vickers high-voltage unit and the Multisource and B.N.F.-M.R.A. low-voltage units.) Over 30,000 readings from more than 15,000 lines have been used in studying the spectra of a nickel-chromium-molybdenum steel containing 0.30% C, 0.25% Si, 0.58% Mn, 0.77% Cr, 2.75% Ni and 0.50% Mo. Illustrations are given of typical oscillograms and high speed camera photographs of discharges, corresponding to the different excitation conditions. From a consideration of the results it is shown that the best results are obtained with the Hilger spark unit, operating with a graphite counter-electrode and a 2.5-mm. spark gap. No important effects on reproducibility were obtained by the use of an air blast across the gap, a 15-sec. pre-spark period or by variation of exposure time.

3560. SHTUTMAN, M. N. AND IVANOV, V. I.

The Spectroscopic Determination of Small Amounts of Nickel in Carbon Steels.

Zavodskaya Lab., 16, 45-7 (1950).

C. A., 46, 59e (1952).

Ni 4714.4 is compared visually with Fe 4721.0; power is supplied by a Sventitskii activated a.-c. arc operated at 10 amp. The counter electrode is a 10-mm. Cu rod whose tip is sharpened to a diam. of 3-4 mm.

3561. SMIT, J. A.

Spectrographic Intensity Measurements.

Nederland Tijdschr. Natuurk., 16, 137-44 (1950).

C. A., 45, 9357c (1951).

A lecture.

3562. SMITH, D. M.

Spectrographic Control in the Refining of Metals.

Inst. Mining and Met. (London), Symposium on Refining Non-Ferrous Metals 1949, 35-44; discussion, 45-50 (1950).

C. A., 44, 7203e (1950).

Arc methods are generally more sensitive than spark methods for detecting traces of impurities. Except for the detn. of Cu, Bi, Ag, Cd, and Tl, spectrographic methods

presently available are not sufficiently sensitive for the complete control of the purity of Pb. Recent developments are reviewed.

3563. SMITH, R. G., CRAIG, P., BIRD, E. J., BOYLE, A. J., ISERI, L. T., JACOBSON, S. D., AND MYERS, G. B.

Spectrochemical Values for Sodium, Potassium, Iron, Magnesium, and Calcium in Normal Human Plasma.

Am. J. Clin. Path. 20, 263-72 (1950).

C. A., 44, 5421e (1950).

Spectrographic detns. of Na, K, Fe, Mg, and Ca were made on heparinized plasma from 103 fasting young adults, and flame photometric detns. of Ca and K made on 70 of them. The av. values of Na were 142 ± 1.8 milliequiv. per l. by flame photometer and 145 ± 5.5 by spectrograph. K detns. gave averages of 4.06 ± 0.26 milliequiv. by flame photometer and 4.11 ± 0.27 by spectrograph. Spectrographic analyses of plasma Fe gave averages of 0.068 ± 0.025 milliequiv. which agrees with chem. analyses reported by others. The av. values of 1.58 ± 0.12 milliequiv. per l. for plasma Mg is lower than most test book figures but agrees with more recent chem. analysis. Spectrographic analysis for Ca gave av. concns. 4.3 ± 0.32 which is significantly lower than those of oxalate pptn. methods, but only slightly lower than those of the ceric sulfate method. There was no evidence of depression in the intensity of the Ca spectral lines by other plasma constituents. Oxalate ppts. by the Clark and Collip method (*C. A.*, 19, 2217) contained 2 contaminants, Mg and protein, each capable of reacting with KMnO_4 . The oxalate ppts. prepd. by the urea neutralization procedure of Willard (*C. A.*, 31, 7353d) gave Mg values corresponding to 0.42 milliequiv. 30 references.

3564. SNYDER, J. Q.

The Use of the Beckman Flame Spectrophotometer in Plant and Soil Analysis.

Proc. Okla. Acad. Sci., 31, 134-6 (1950).

C. A., 46, 6549i (1952).

Extn. of soil samples with aq. NH_4OAc and digestion of plant samples with HNO_3 and HClO_4 gave solns. for routine detn. of Na, K, Ca, and Mg with the Beckman flame spectrophotometer. Calibrations and corrections permitted detn. of 95-100% of known wts. of these ions added to plant samples.

3565. SOBOLEV, N. N., MBZHERICHER, E. M., AND RODIN, G. M.

Dependence of the Intensity of Spectral Lines on the Concentration of the Element in the Flame.

Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., 14, 737 (1950).

C. A., 45, 4134d (1951).

The total energy of spectral lines emitted by alkali and alk. earth metals in C_2H_2 flames is at small concns. proportional to the concn. and at large concns. proportional to the $\sqrt{c}$. From contour measurements the abs. width of line Na 5890 Å was found to be 0.085 Å; that of line Ca 4227, 0.06 Å. At higher concns. the contour increases owing to internal conversion.

3566. SOROKINA, N. N.

Spectrographic Investigation of Working Curves for Solid Alloys and Solutions.

Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., **14**, 567-71 (1950).

C. A., **45**, 6966d (1951).

Studies have been made to replace metal alloys as standards for working curves by their solns. and by mixt. of salts of the same metals. The systems Fe-Cr, Fe-Mn, and Ni-Cr were studied with the Feussner spark. When salts were examd., the C-electrodes were soaked with their soln. and dried. It is shown that for all line pairs the same working curves were obtained for all 3 types of standards.

3567. SPENCER, A. G.

Flame Photometry.

Lancel, **259**, 623-7 (1950).

C. A., **45**, 3017g (1951).

A brief review of the applications of the flame photometer with special reference to its use in the estn. of Na and K in biol. fluids. 15 references.

3568. STEEL, S. D., ET AL.

Contribution of the Source Unit to Variability in Spectrographic Analysis. By the Spectrographic Analysis Sub-Committee.

J. Iron Steel Inst. (London), **166**, 325-8 (1950).

C. A., **45**, 5054e (1951).

About 20-50% of the total error in spectrographic ferrous analysis with photographic recording can be traced to source contribution.

3569. STRASHEIM, A.

An Improved Electrode Holder and Cutter.

Spectrochim. Acta, **4**, 2-7 (1950).

C. A., **44**, 6685g (1950).

The universal electrode holder designed by Scribner and Corliss (*C. A.*, **37**, 1626^g) has been improved to include the following: (1) slot and fine adjustment on upper and lower electrode jaws to align electrodes (1.5 to 10 mm.) opposite each other accurately in the vertical and horizontal directions; (2) a quick-release gear for raising and lowering the lower electrode holder; (3) a lever gear mechanism for continuous alignment of electrodes along the optical axis of the spectrograph; (4) a V-groove slotting of the elec-

trode jaws for a firmer grip of electrodes. An improved cutter, with which electrodes as 0.5 cm. can be shaped, is described.

3570. STRASHEIM, A.

The Spectrographic Analysis of Uranium in Uranium Ores.

Spectrochim. Acta, **4**, 200-11 (1950).

C. A., **45**, 2366d (1951).

Three methods for the spectrographic detn. of the U content of ores are described: (a) vaporization of the sample mixed with 90% graphite in a graphite electrode with an arc current of 15 amp.; (b) prior chem. extn. especially from ores with high content of Ca; and (c) direct burning of the sample in a d.-c. arc with addn. of $PbCl_2$ as an enhancing agent for U lines. The most sensitive U lines are 4241.7 and 4244.4 Å, and for internal standard lines, La 4238.4, V 4232.5, Fe 4238.8, Fe 4247.4 Å were used. Method (a) can be used for the rapid detn. of 0.1 to 6% U_3O_8 in ores. Methods (b) and (c) were found suitable for the detn. of 0.1 to 0.006% U_3O_8 with a precision of about 11%.

3571. SUKHENKO, K. A.

Spectral Analysis of Steels and Alloys.

Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., **14**, 590-7 (1950).

C. A., **45**, 6966a (1951).

A rapid spectral analysis of highly alloyed steel for Cr, Mn, W, Ni, Si, Mo, Ti, and V is described briefly. Mg alloys are analyzed for Al, Mn, Ni, Ce in a spark discharge, Ni and Ce in an a.-c. arc. The working conditions and line pairs are given and working curves are shown for Ce and Ni. For Ce the line pairs were Ce 4186.60/Mg 4167.39 (spark, error = 6.5%) and Ce 4186.60 and 4137.65 against background (arc, error = 9.5% to = 10.8%). Ni-alloys were analyzed for Ti, Al, Mn in concn. 0.15-4.0% (line pairs are given). A C electrode with a spherical tip is recommended in this case. "Avial" (Cu 0.01-0.8%) and "Duralumin" (Cu 1.8-5%) have the same working curves for Mg, Mn, Fe, and Cu. Also Ni and Mn do not influence the detn. of Fe in Al-Fe bronze. Working curves of different elements are shown for 3 such bronzes. Working curves were established for a Ni-alloy, a Co-alloy, and steel contg. equal amounts of Cr, Ni, and Mn. It is shown that Si affects the detn. of Cr in Ni alloys. Other working curves have a parallel displacement.

3572. SUKHENKO, K. A.

Spectrographic Determination of Major Constituents in Light Alloys.

Zavodskaya Lab., **16**, 459-63 (1950).

C. A., **46**, 1389a (1952).

By using a 2.5-mm. arc gap, a Mg counter electrode, no self-inductance, 0.003 μF

capacitance, and a 30-sec. exposure, and measuring the intensity ratio Al 3587/Mg 3330, 3-12% Al in Mg can be detd. with a mean deviation of 4.5%. Under the same conditions and with a 90-sec. exposure and an Al counterelectrode, 9-16% Mg can be measured in Al alloys with a mean deviation of 4% by using the line pairs Mg 2915/Al 2652 or Mg 2776/Al 2652. High concns. of Cu in duralumin were detd. by using a condensed spark with the following parameters: secondary voltage 14 kv.; capacitance 18,000 cm., inductance 8×10^5 cm., and arc gap 2 mm. Measurement of Cu 2824/Al 2816 or Cu 2824/Al 2652 gave a mean deviation of 3-6% for a single detn.

3573. TACHIBANA, Y.

Application of Spectral Analysis in Criminal Researches.

J. Soc. Sci. Phot. Japan., 12, No. 4, 51-5 (1950).

C. A., 46, 3895i (1952).

Actual examples are given, such as the spectral analyses of cloths, cosmetics, and tobacco ashes.

3574. TAGANOV, K. I.

Spectroscopic Method for Determining the Thickness of Metallic Coatings with the Steeloscope.

Zavodskaya Lab., 16, 457-9 (1950).

C. A., 46, 1391c (1952).

The time required for a given line of the base metal to attain the same intensity as a given line of the coating metal varies linearly with coating thickness. For a given thickness, this time varies linearly with the arc-gap width. Thicknesses between 5 and 40 μ can be detd. to within $\pm 20\%$ in a single exposure.

3575. TAGANOV, K. I.

The Transport of Material in the Discharge During Spectral Analysis.

Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., 14, 634-40 (1950).

C. A., 45, 6955g (1951).

The method of spectral analysis by transference (cf. *C. A.*, 44, 3833f; 42, 8695a) has been applied to a study of the transport of matter. Erosion-resistant materials, such as Al, W, Cu, and Mo, are transported mainly from the anode, others such as Cd, Ni, Pb, Sb, and Zn, mainly from the cathode. Fe changes preference, depending on the inter-electrode distance. From transport measurements on Zn deposited on a rotating Cu disk the duration of the arc-discharge is calcd. to 0.006 sec., the duration of the interval to 0.004 sec.; calcs. made on the diffusion of particles in the arc show that the transport of material results from diffusion and from pos. ion mobility. An app. has been de-

veloped to prepare samples for analysis by spark transference outside the laboratory.

3576. THIERS, R. E.

Step Sector for the Astigmatic Spectrograph.

J. Optical Soc. Am., 40, 849-51 (1950).

C. A., 45, 1871b (1951).

A step sector is described which can be used with astigmatic spectrographs to give results in every way as good as those obtained with conventional sectors and stigmatic instruments. In its action it may be described as a cross between a focal plane shutter and a band saw, as it consists of a continuous band of opaque film with a succession of stepped openings cut from its center. This film is passed at high speed in front of the focal curve next to the sensitive emulsion, then around a return path which is not in the optical path of the instrument. Added versatility is achieved by the inclusion of adjustable vertical and horizontal masks.

3577. TIGGELEN, A. VAN AND AUSLOOS, P.

Spectrographic Study of Flames.

Bull. soc. chim. Belges, 59, 551-7 (1950).

C. A., 45, 6926e (1951).

By detg. the intensity of different bands it is possible to deduce the relative amts. of emitting radicals in different parts of a flame propagated in a gaseous mixt. Typical data for mixts. of NH_3 and O_2 are given.

3578. TONGEREN, W. VAN

Some Experimental Difficulties of Direct Evaluation of Intensities of Spectral Lines.

Congr. groupe. avance. method. anal. spectrograph. produits mèl., 13, 33-40 (1950).

Quantitative spectrochemical analyses with direct-reading spectrometers employing electron-multiplier photo tubes and auxiliary electrical equipment may contain small errors on account of (1) loss of electricity due to leakage in ohmic resistances, (2) loss from parasitic capacities, (3) influence of temperature and atmospheric pressure, (4) properties of photoelectric cells, (5) interferences of high frequency emitted by the light source with the electric circuits to be measured. These effects are discussed in detail and quantitatively.

3579. TRAYNARD, P.

Photomultiplier Phototubes and Their Application in Spectroanalysis.

Rev. met., 47, 409-20 (1950).

C. A., 44, 8759d (1950).

General survey based on 18 references.

3580. TRELLES, R. A. AND AMATO, F. D.

Arsenic, Vanadium, and Molybdenum in

the Soils and Certain Strata of the Argentine Republic.

Anales soc. cient. argentina, 149, No. 3, 93-107 (1950).

C. A., 44, 7469i (1950).

Soils from all parts of Argentina were analyzed for As, V, and Mo. Arsenic occurred in amts. varying from 0.1 to 5.3 mg. per 100 g., V in amts. from 2 to 160 mg. per 100 g., and Mo from 0.2 to 2.4 mg. per 100 g.

3581. TRICHÉ, H.

Spectroscopic Phenomena Produced by the Tesla Spark.

Compt. rend., 230, 1659-61 (1950).

C. A., 44, 10501i (1950).

When a Tesla spark is used to localize the emission in the vicinity of the electrodes, the spectra from FeS and Fe are not identical. The weakening of the spark by the S is important. It is characterized by a variation in intensity of two spectral lines belonging to the same element. The source modifies the compn. of the electrode until the nature of this electrode modifies the conditions of the emission. In particular, there results a variation of the intensity of 2 spectral lines of the same Fe multiplet. When one passes from Fe to FeS, the most intense components are weakened relative to the others.

3582. TRICHÉ, H.

Analysis of a Phase of an Alloy and the Manifestation of the Physico-chemical State of an Element by Means of Its Emission Spectrum.

Colloque intern. spectrographie Strasbourg, Oct., 1950, 185-90.

A spark operated by a Tesla coil can be localized to a very small point-like area on an electrode and furnishes, therefore, an excellent method for studying the composition and physicochem. properties of the cryst. grains in an alloy. The electrodes are prepd. and polished and etched metallographic samples. Applied to binary alloys of two phases, such as Cd-Bi, Cd-Sn, brass, and to alloys of several components in two or more phases, such as cementite contg. Cr or Ni, the method permits detn. of the solubility of a metal in the solid state, the distribution of impurities between the phases, etc. The change in relative intensities among the lines of a neutral atom and its ion is a function of the vapor pressure of the element in the spark discharge, the amt. of the vapor being proportional to its rate of dissocn. from the cryst. by the spark.

3583. TRICHÉ, H.

Study of the Spectra of Iron Obtained from Pure Iron and from Iron Sulfide.

Congr. groupe. avance. method anal. spectrograph. produits mét., 13, 167-73 (1950).

A study of condensed-spark spectra of pure iron and of iron sulfide shows intensity differences among certain lines of Fe multiplets. These are ascribed to self-absorption, and possibly to cumulative impacts or to collisions of the second kind in the light source. To yield good quantitative results the source should be independent of the nature of the electrodes as well as reproducible.

3584. VALLÉE, B. L., REIMER, C. B., AND LOOFBOUROW, J. R.

Influence of Argon, Helium, Oxygen, and Carbon Dioxide on Emission Spectra in the Direct-Current Arc.

J. Optical Soc. Am., 40, 751-4 (1950).

C. A., 45, 449c (1951).

The study of the distribution and function of trace metals or oligometals in biol. systems has been retarded by lack of methods of sufficient sensitivity and accuracy. The problem is to detect a faint spectral line (signal) on a continuous background (noise) when the spectrum of the sample, excited in a d.-c. arc, is photographed with a spectrograph. A gas-tight arc stand has been constructed to study the influence of A, He, O, CO₂, and various mixts. of these on emission spectra produced in the d.-c. arc. The band spectra of CN are replaced, and in most lines studied the signal-to-noise ratio is better in A and He than in air. A 2- to 100-fold increase in the signal-to-noise ratio has been observed. It is suggested that this technique may prove useful in spectrochemistry.

3585. VAN SOMEREN, E. H. S.

The Search for the Cause of Calibration Line Drift in the Spectrographic Analysis of Steel.

Colloque intern. spectrographie, Strasbourg, Oct., 1950, 121-5.

C. A., 46, 6993g (1952).

The cause for calibration line-drift was sought by several labs. The effect of variation of temp., humidity, and the atm. pressure on the light source and the photographic emulsion was studied. The humidity of the plate storage largely controls the humidity of the plate emulsion; this in turn influences line drift; changes in humidity at the light source are less important.

3586. VAN SOMEREN, E. H. S.

Precision in Metallurgical Analysis.

Metallurgia, 42, 52 (1950).

C. A., 44, 8813h (1950).

A note on the statistical treatment of data of chemical and spectrographic determinations on ferrous samples. The precision is shown to decrease regularly with concentration of the element determined.

3587. VARSHAVSKAYA, L. N., IVANTSOV, L. M., AND POLYAKOVA, V. V.

Spectrographic Determination of Impurities in Metallic Nickel.

Zavodskaya Lab., 16, 48-51 (1950).

C. A., 46, 59d (1952).

Line-pairs and operating details are given for detg. small quantities of Fe, Si, Co, and Cu in Ni with a high-voltage spark.

3588. VASSY, A. AND VASSY, E.

Exaltation of Spectral Sensitivity at 3500 Å Observed with Pure Silver Bromide Emulsions.

Compt. rend., 230, 1266-8 (1950).

C. A., 44, 5237f (1950).

The shape of the spectral sensitivity curve in the region 4000 to 2800 Å depends upon upon the d. at which sensitivity is detd. The appearance and growth of a max. at 3500 Å, with pure AgBr emulsions depend upon the duration of keeping, the duration of ripening, and the excess of bromide at the time of prepn. The emulsion contg. the largest excess of bromide showed the greatest growth of the 3500 Å band.

3589. VESELOVSKAYA, I. M., KORITSKIĬ, V. G., AND FILIMONOV, L. N.

The Use of Carbon Electrodes for the Spectrographic Analysis of Alloys.

Zavodskaya Lab., 16, 438-46 (1950).

C. A., 46, 1382h (1952).

Since C electrodes emit no metallic vapors and provide a reducing atm., they greatly retard the formation of a nonconducting oxide coat on the electrode during sparking. The sparked area is therefore larger, and local heating slower, than when both electrodes are metal. The Fe spectrum attains max. intensity much faster in O₂ than in air or N₂. Steels which oxidize fastest attain max. intensity fastest during sparking; the spark-off period should be varied accordingly.

3590. WALCHER, W.

Atomic Spectroscopy with Separated Isotopes.

Nucleonics, 6, 28-36 (1950).

Spectrochim. Acta, 4, 415 (1951).

The use of hyperfine structure of spectral lines for qual. and semiquant. detn. of isotopic composition of an element is described. Examples with photographs include the mixtures Rb⁸⁵, Rb⁸⁷; Pb²⁰⁸, Pb²⁰⁷; Tl²⁰³, Tl²⁰⁵; Sr⁸⁸, Sr⁸⁶; U²³⁵, U²³⁸; U²³³, U²³²; and U²³¹, U²³⁰.

3591. WALSH, A.

Spectrographic Analysis of Uranium.

Spectrochim. Acta, 4, 47-56 (1950).

C. A., 44, 7183h (1950).

A tentative method for the spectrographic detn. of Fe, Mn, Si, Cu, Ni in metallic U has been developed. The only sample prepn.

required is the cleaning of a flat surface of 1 cm. diam. Highly purified graphite rods are used as counter electrodes. Because a high-voltage condensed spark gave insufficient sensitivity and the d.-c. arc produced irregular spectra, the spectra were excited with a general purpose source unit with C = 240 microfarads, L = 0.5 millihenry, R = 12 ohms, and V = 310 v. Analyses were made by comparing line intensities with those in spectra of standard alloys prepd. by a vacuum fusion technique and chemically analyzed. The lines employed and lower limits of quant. analysis were as follows: Fe 2382 Å, 0.01%; Si 2516 Å, 0.005%; Mn 2576 Å, 0.001%; Cu 3274 Å, 0.002%, 3414 Å, 0.01%.

3592. WALTZ, E. O.

Use of the Spectroscope in the Steel Industry.

Blast Furnace Steel Plant, 38, 662-5 (1950).

Spectrochim. Acta, 4, 312 (1951) (an abstract).

The author surveys the practical aspects of spectrochemical analysis in volume control in the manufacture of steel. It is estimated that on the average 0.5 man-hours are saved per test compared to the wet chemical method. Considering the low average of 4 tests per heat results in a saving of 2 man-hours per heat melted. The author's laboratory services seven electric arc and six open hearth furnaces whose combined average daily output is 20 heats, or a 40 man-hour saving per day. To this must be added the saving in furnace time due to the greater speed of the spectrochemical method in getting the analysis to the melt shop. All factors combined, the average annual financial saving over a three-year period is estimated at about \$75,000, which is well in excess of initial installation costs.—The procedure here considered employs the standard photographic plate method and assumes carbon, sulphur and phosphorus still to be obtained by chemical analysis. Replacing these methods by direct reading instruments capable of further savings is considered as a possibility for the not too distant future.

3593. WEBSTER, R. R.

Instruments for Rapid Metal Identification.

Am. Soc. Testing Materials, Symposium on Rapid Methods for the Identification of Metals, *Spec. Pub. No. 98*, 35-48 (1950). *C. A.*, 45, 6979d (1951).

Properties found useful in metal identification are: hardness, elec. resistance, magnetic characteristics, thermoelec. effect, quality of sparks during grinding, radiation from an elec. arc with electrodes made of the material to be tested, and frictional electricity. Among the instruments discussed are: spec-

troscopes, hardness testers of various types, Indentometer, magnetic comparators, Metal-sorter, and resistance testers.

3594. WEST, P. W., FOLSE, P., AND MONTGOMERY, D.

Application of Flame Spectrophotometry to Water Analysis—Determination of Sodium, Potassium, and Calcium.

Anal. Chem., **22**, 667-70 (1950).

C. A., **44**, 8025i (1950).

In theory, introduction of these ions into a high-temp. gas flame produces radiations whose intensity is proportional to their concn. Practically, intensity is affected by the presence of other cations (also HCO_3^- for Ca). Hence "emission buffers" similar in principle to those sometimes used in emission spectrography were employed; for Na, water satd. successively with Ca, K, and Mg chlorides; for K, with Na, Ca, and Mg chlorides; and for Ca, with Na, K, and Mg chlorides. Use of these buffers, in the proportion of 1 ml. to 25 ml. of sample, renders negligible the effect of natural variations in concn. of diverse ions. With the Beckman D.U. spectrophotometer and flame unit, standard curves are prep'd., with the appropriate buffer, for Na, K, and Ca at 589,767, and 556 $\text{m}\mu$, resp. Each calibration point must be corrected for background luminosity. Practical ranges are 0-100 p.p.m. for each metal. Unknowns are read with the instrument adjusted for sensitivity by means of a standard sample, preferably near the concn. of the unknown cation sought. Results compare well with those of chem. analyses. Higher flame temps. may permit accurate detn. of Mg.

3595. WEICHELBAUM, T. E.

Lamp for Spectrophotometric Analyzer.

U. S. Patent 2,532,687, Dec. 5, 1950.

C. A., **45**, 9931a (1951).

Control means is described for the rate of flow and quantity of injected fuel gases and analyzed solution.

3596. WIJNEN, J. AND TIGGELEN, A. VAN

Quantitative Spectral Analysis of Gaseous Mixtures. I. Mixtures of Carbon Dioxide and Nitrogen in the Presence of Oxygen.

Spectrochim. Acta, **4**, 8-12 (1950).

C. A., **44**, 7185e (1950).

Because of certain difficulties involving gas pressure, clean-up, and other constituents, few researches have been published on the spectrographic detn. of mixed gases. It is shown that quant. detns. with very good precision can be made of CO_2 and N_2 mixts. The gases are sealed in glass tubes at pressures of 2 to 3 mm. Hg after carefully outgassing the tubes for several hrs. at about 400°.

The spectra are produced by connecting cylindrical external electrodes to the poles of a high-frequency generator of waves 11 m. long. The spectra are photographed with a Hilger spectrograph and stepped sector, and intensity ratios are measured for a N band head at 3159.3 Å and a CO band at 3134.4 Å. These ratios change because clean-up is greater for N than for CO_2 but this effect is negligible if the observations are confined to the first moments of the discharge. A precision of 1% can be attained in the detn. of CO_2 in the range of 50 to 95%, and for N a precision of 3.5% in the range from 4 to 40%. The O pressure is of no influence unless it exceeds 20% of the mixt.

3597. WILBERG, E.

Flame-photometric Determination of Lithium.

Z. anal. Chem., **131**, 405-9 (1950).

C. A., **45**, 1907e (1951).

Riehm (*C. A.*, **42**, 5795h) has recently described his method for detg. K, Na, and Ca and here the detn. of Li is described with 0.04-0.20 milliequiv. of Li in 100 ml. Excellent results were obtained in 25 expts. A mixt. of K and Li can be analyzed by first detg. the sum of the Li + K in the soln. and then comparing the results with the calibration curves of pure Li and pure K solns. Details of the app. and procedure are given.

3598. WILLEBRANDS, A. F., JR.

The Determination of Sodium and Potassium Blood Serum and Urine by Means of the Flame Photometer.

Rec. Trav. Chim. Pays-Bas, **69**, 799-821 (1950).

Spectrochim. Acta, **4**, 314 (1951).

The flame photometer used for the determination of sodium and potassium is a modification of that described by S. D. Boon (Diss. Amsterdam 1945). The flame utilizes butane at 20 cm. water pressure, with a stainless steel gas jet 0.5 mm. in diameter. The burner tube is of Pyrex, with a platinum burner tip consisting of two concentric platinum cylinders 9 and 7 mm. in diameter. Air is supplied via an atomizer to a side tube of the Pyrex burner tube. The atomizer is of the injector type and similar to that of Boon. Air at 70 cm. mercury pressure is fed vertically into a glass expansion chamber through a jet with an internal diameter of 0.6 to 0.7 mm. The liquid is sucked by the air jet horizontally through a capillary with a jet diameter of 0.2 to 0.3 mm. The amount of liquid used is about 10 ml. per min, but only about 5% of this is fed to the flame, the remainder is about 10 ml. per min, but only about 5% of this is fed to the flame, the remainder settling in the expansion chamber. A brass chimney surrounding the

flame has two side tubes at the flame height containing lens systems for focussing images of the flame on the photo-cells. For sodium, the light from the 5890/6 doublet is filtered by means of a 1.5 cm. thick layer of copper sulphate solution (57 g. per liter), and then falls onto a selenium barrier layer photocell, the output of which is read on a galvanometer. For potassium, light from the 7665/99 doublet is filtered by a Schott RG.2 red filter, and then falls onto a gas-filled caesium cell. The output of this amplified by a d.-c. amplifier and read on a galvanometer. Urine samples for the determination of sodium and potassium are prepared by filtration and 1 to 100 dilution with water, and are then sprayed directly into the flame. Serum or plasma samples for the determination of sodium are prepared by 1 to 100 dilution of the fresh sample with water and using this solution immediately to prevent coagulation of the proteins. For the determination of potassium in serum or plasma it was found that dilution of the serum 1 to 25 with water gave equally as good results as deproteinizing the sample with trichloroacetic acid or colloidal dialyzed iron hydroxide, or by wet acid ignition of the serum. Possible errors in the method are considered. Differing viscosities, for example, between the diluted samples and the standard solutions were found to have little effect. The determination of sodium is not influenced by the normal amounts of K, Ca, and Mg present in serums, but in urine slight errors may occur if more than 200 m. eq. of K per liter is present. No interference is encountered from Na, Ca, and Mg in the determination of potassium.

3599. WOLFF, H.

Emission Spectrographic Analyses of Cobalt in Serum.

Klin. Wochschr., 28, 280 (1950).

C. A., 44, 10775i (1950).

Preliminary expts. to det. the amt. of Co in serum spectrographically were performed. To counteract the cyanogen band system, the prisms of the spectrograph (Steinheil GH) were turned from the min. position of aberration until single isolated lines were seen. Co I 4121.3, Co I 3995.3, Co I 3502, and Co I 3453 were used as standards for CO. The cyanogen lines were retarded through the burning of a cooler arc, accomplished by the use of a NaCl soln. Values in 8 samples varied from 0.39 to 1.48%. Maximal variation for single readings was $\pm 25\%$.

3600. WOLFF, H.

Analytical Fundamentals of Clinical Research on Trace Elements.

Naturwiss., 37, 536-7 (1950).

Spectrochim. Acta, 4, 417 (1951).

The fruitful application of spectrochemistry

to the quant. trace detn. of Co and Mn is mentioned.

3601. WOODRUFF, J. F.

The Use of Briquetted Samples in the Spectrochemical Analysis of Carbon and Alloy Steels and Other Metals.

J. Optical Soc. Am., 40, 192-6 (1950).

C. A., 44, 6342b (1950).

Routine analysis of steel, zinc, and zinc-base alloys in the form of briquetted powders, drillings, millings, nibblings, and grindings is described. Low and plain C steels are analyzed quantitatively for such elements as Sn, Pb, Mn, Ni, Cr, Mo, Co, Ti, Al, Zn, and B. Zn and Zn-base alloys are analyzed quantitatively for Cd, Fe, Pb, Sn, Sb, and Al. Briquets are made by compressing chips, etc., in a 0.25-in. mold. Sample holders, source units, spectral lines utilized, and precision and accuracy data over a 5-year period are discussed. For the most part, the av. deviations observed between spectrographic and chem. detns. are sufficiently small to permit use of the spectrochem. method for routine control. In some cases, the spectrographic detns. surpass in accuracy the routine chem. detns.

3601a. YAKOVLEVA, N. P.

Determination of Nickel and Cerium in Magnesium Alloys by a Spectral Method.

Zavodskaya Lab., 16, 1254-6 (1950).

C. A., 47, 3177i (1953).

Detns. were with spectrograph Q-24; excitation was by spark and a.-c. arc. By using a spark and lines Ni 3524 and Mg 3074 and Ni 3414 and Mg 3074, relative error of 62 detns. was $\pm 6.4\%$. With an a.-c. arc and lines Ni 3524 and Mg 3330 and Ni 3414 and Mg 3330, relative errors were $\pm 9.6\%$ and $\pm 8.7\%$ resp. For Ce with arc, best results were obtained with lines Ce 4137.6 (background measured from left) and Ce 4186.6 (background measured from right) with relative errors of $\pm 9.5\%$ and $\pm 10.8\%$ resp.

3602. YAMAGATA, N.

Content of Alkali Metals in the Ash of Tobacco Leaves.

J. Chem. Soc. Japan, Pure Chem. Sect., 71, 288-92 (1950).

C. A., 45, 4889i (1951).

Spectrographic analyses were made on 15 samples of Japanese and 2 samples of American tobacco leaves. Vein part of the leaves contained larger quantities of K, Rb, Sr, and Ba and smaller quantities of Li, Na, and Cs than the remaining parts. All of the 5 alkali metals were found in every sample; K: 5.3-27.8 av. 18.3%, Na: 0.4-10.2, av. 3.0%, Li: max. 6×10^{-4} , av. 1.8×10^{-4} %, Rb: 0.4×10^{-1} % av. 0.02%.

Cs: max. $1.7 \times 10^{-50\%}$. Ratios in wt. are K/Rb: 920, Na/Li: 17,000 and K/Cs: 8×10^{-6} .

3603. YAMAGATA, N.

Geochemical Studies on Rare Alkalies. II. Rare Alkali Content in Soils.

J. Chem. Soc. Japan, Pure Chem. Sect., **71**, 567-9 (1950).

C. A., **45**, 6781f (1951).

Fifteen samples of Japanese soils were analyzed for Na and K contents chemically and for Li, Rb, and Cs contents spectrographically by the cathode-layer method. Av. amts. expressed in at. ratio against Na = 100 were K 13, Li 0.04, Rb 0.03, and Cs 0.0005. Volcanic soils were poorer in rare alkalies than were soils of sedimentary origin. The Li content of soils is much less than that of rocks. The amts. of rare alkalies absorbed in tobacco leaves decrease with increasing at. wt.

3604. YOUNG, L. G. AND BERRIMAN, J. M.

Spectrographic Determination of a Major Constituent of a Solution.

Nature, **166**, 435 (1950).

C. A., **45**, 2363e (1951).

A soln. spark technique for detg. the major constituent of a soln. has been developed. It consists of placing the soln. under investigation in an upper electrode, which is a narrow graphite cup with a porous base permeable to the soln.; the lower electrode is a solid graphite rod. By using the Hilger medium spectrograph and a standard spark source, an analytical curve can be obtained from the line pair Zn 2502.001/Cu 2544.802 for the range Zn 10-90 and Cu 90-10%. The results obtained by this method seem to commend the method as having wide potentialities for extending the range of spectrochem. analysis.

3605. ZAK, K. K. AND RUVINSKAYA, R. V.
Spectral Analysis in Electrical Battery Production

Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., **14**, 655-9 (1950).

C. A., **45**, 7443e (1951).

Pb powder for batteries is melted in an elec. arc. to form electrodes for a Feussner type spark generator. Concns. of Bi (0.004-0.01%) and Cu (0.0005-0.01%) were detd. with the line pairs Cu 3247.5-Pb 3240.2 Å and Bi 3067.7-Pb 3118.9 Å. The working curve of As in concns. 0.0007-0.05% was based on relative intensities of the As line 2349.8 and the adjoining mol. As spectrum. Ti 0.0002-0.01, Zn 0.002-0.05, Pb 0.004-0.10, and Cu 0.02-0.03% were detd. in Cd in an a.-c. arc discharge with the line pairs of Ti 3519.21, Zn 3345, Pb 2614.20, Cu 3273.96, and the Cd line 3250.29. At higher concns. of Cu (0.02-0.10%), a Feussner generator was used.

3606. ZOLINA, Z. M., GORODINSKIĬ, S. M., KRAPIVENTSEVA, S. I., KHALISOVA, O. D., SHELUDYAKOVA, M. P., SHCHIRSKAYA, V. A., AND MUMZHU, E. A.

Improvements of Health Hazards in Spectral Analytic Laboratory Work.

Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., **14**, 703-7 (1950).

C. A., **45**, 6956a (1951).

A description is given of different factors such as O₂, N oxides, and CO content in different zones around the arc. O₂ concn. of 0.7-1.0 mg./cu. m. far exceeds the safe limit of 0.1 mg./cu. m. The amt. of N and C oxides was close or slightly above the safe limit. Also examined was the fatigue created by visual strain during work on the steeloscope and the visual photometry of plates.