Overview

For years ASTM Committee E-3 on Chemical Analysis of Metals has held symposia relating to the analysis of metals and alloys, which produced special technical publications. Committee E-3 is concerned with the standardization of referee methods relating to chemical analysis of metals and alloys for compliance with compositional specifications. The symposium "Chemical Analysis of Metals" was held in concurrence with the celebration of the 50th anniversary of Committee E-3 and the 25th anniversary of Committee E-16 on the Sampling and Analysis of Metal-Bearing Ores and Related Materials. In constructing the program, suggestions were sought from knowledgeable people engaged in the use and development of standards.

ASTM Committee E-3 has subcommittees, two that deal with the analysis of ferrous and nonferrous materials, thus this symposium provides information relative to the analysis of these materials. For the last 50 years, a great deal of time and effort has been spent developing referee methods for use by producers and users of metals and alloys as well as by commercial, governmental, and educational laboratories. The subject material was organized with a view to expounding upon the state of the art, development and application to future needs. E-3 standard methods are based upon chemical dissolution of the samples followed by detection and measurement of the elements of interest. Pertinent papers on these subjects were selected and reviewed for this volume.

The paper entitled "Rapid Dissolution of Steel Industry Materials for Chemical Analysis" provides information of value to chemists involved in the analysis of these materials. This covers selection of proper acids and fusion media in order that the selected method of analyses can give acceptable results. After proper dissolution, measurements can be made by atomic absorption spectroscopy, photometry, redoximetric, or complexometric titrations. Examples are given which include data on accuracy and precision.

"Novel Sample Preparation Techniques for Chemical Analyses—Microwave and Pressure Dissolution" further addresses the importance of sample dissolution with respect to performing high volume analyses with speed, reliability, and safety. Classical old techniques and new techniques are discussed, and examples achieved through their use are presented.

"The Application of Ion Exchange to the Determination of Impurities in Aluminum and Aluminum Alloys" is a vivid example of work that has led to a new standard, which is incorporated in the revision of aluminum analytical

methods. Separation of aluminum has considerably lowered the detection limits for residual metallic impurities.

Classical volumetric analysis is widely used in the laboratory. The presentation on the "Applications of Automatic Titration Instruments in the Specialty Metals Industry" offers valuable hints on how the use of automatic titrators has led to improved precision and performance. The details involving analyses of specialty metals for major levels of various elements such as chromium, vanadium, boron, and cobalt are presented.

The ongoing transition of elemental analyses is demonstrated by the authors in their paper entitled "The Use of Modern Atomic Spectroscopy in an Industrial Laboratory." One laboratory's experience with the DC plasma Echelle Grating Spectrometer is followed through various stages of usage until it is now the mainstay of their analytical methodology.

An interesting excursion through the analytical chemistry of beryllium is portrayed under the title of "General Analytical Chemistry of Beryllium." The reader may follow the evolution of methods from the classical of the past to modern day instrumental techniques. Volumetric, spectrophotometric, gravimetric, and fluorometric methods have largely been replaced by atomic absorption, plasma emission methods. The chemistry of beryllium and its similarity to that of other elements is demonstrated. The evolution of analytical techniques and the descriptions of the methods are of value to all chemists, since this evolution is taking place with respect to elemental analyses of all metals and alloys.

The needs of modern industry have led to automation in almost every aspect of manufacturing. This volume addresses the utilization of laboratory automation in the paper entitled "Microprocessor-Based Determinator Design and the Impact of Future Trends in the Area of Computer-Controlled Automation of Analytical Chemistry Methods." Some examples are discussed at length.

Analytical laboratory information management as used in a metals laboratory is presented under the title "Analytical Laboratory Information Management System (ALIMS)." A computerized system used to control laboratory sample information from log-in to completion is detailed. Instruments controlled by the system include inductively coupled plasma, atomic absorption spectroscopy, optical emission spectroscopy (ICP, AAS, OES) balances, Leeco Diagnostics (LECO) analyzers, spectrophotometers, and automatic titrators.

The utilization of inductively coupled plasma emission spectrometry has progressed at a rapid pace. The author of "Quality Assurance in Metals Analysis Using Inductively Coupled Plasma" describes methods of assessing the quality of analytical results.

"Interdependence of Chemical and Instrumental Methods of Analysis" provides information relating to many aspects of classical and chemical deter-

minations used separately or together. Examples are given in the analysis of precious and base metals.

In summary, this publication has been organized to provide analytical chemists with information relating to all phases of metals analysis starting with the dissolution of samples. The use of various analytical techniques is described followed by examples in the ferrous and nonferrous industries. The evolution of methods and development of standards is based upon the free dissemination to the chemist of information of this type. The contributors to this volume have presented practical working chemists with information that can be utilized further, improved upon, and thus lead to ongoing progress in the analysis of metals. Further work will lead to more standard methods, better quality control, automation, and improved analytical information as required by producers, users, governmental, academic, and accreditation agencies.

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