
BOOK REVIEWS

Sludge Treatment

Reviewed by S. L. Daniels, Dow Chemical U.S.A., Environmental Sciences Research, Midland, MI. Member of ASTM.

REFERENCE: Eckenfelder, W. W., Jr. and Santhanam, C. J., Eds., *Sludge Treatment*, Marcel Dekker, New York, 1981, 591 pages.

Sludge Treatment covers a rather "amorphous" topic in a number of appropriately broad subcategories: characteristics, handling, processes, regulation, and research, as contributed by a number of active workers in a rather unglamorous field. It includes both historic and future perspectives. Unlike earlier books, it properly addresses all sludges, both municipal and industrial, although no generators of sludges or producers of chemical additives are among the coauthors.

The introduction, although brief, adequately sets the stage for the rest of the book. It is stated somewhat unfairly, however, that the evaluation toward more efficient treatment has led to the creation of sludges that are more difficult to handle when greater quantities are meant. The characterization of sludges (Chapter 2) includes the familiar parameters as well as a brief discussion of rheology. The latter could have been expanded to emphasize non-Newtonian behavior of sludges. Although this aspect is covered well under handling of sludges (Chapter 3), odor control was allotted only three pages.

The various chemical and physical methods of sludge conditioning (Chapter 4) are sufficiently addressed. Older techniques of evaluation, such as the Buchner funnel filtration, are compared to newer techniques, such as the capillary suction time and the shear strength of conditioned sludge flocs.

A good balance is maintained between sludge thickening and storage (Chapter 5) while recommending practical engineering procedures and designs. The occasional mentions that chemical sludges or chemically conditioned sludges are much larger in bulk or more difficult to dewater than conventional sludges, however, does a disservice and is contrary to the view held by other workers in the field.

The dewatering of sludges (Chapter 6) encompassed drying beds, lagoons, vacuum filters, and centrifuges, although pressure filters are somewhat hidden under other types considering a pressure unit is on the front cover of the book. The details regarding all types, however, are well treated. The discussions on anaerobic digestion (Chapter 7) and aerobic digestion (Chapter 8) are welcomed additions. Both inject more science than many preceding books. It is encouraging to have the myth dispelled that digestion is not fundamentally unstable or difficult to control. A balanced perspective of toxicity of various sludge components is provided.

Thermal methods of sludge treatment (Chapter 9) emphasize multiple hearth, fluid bed, and wet air oxidation, but much less treatment of flash drying, pyrolysis, cyclonic units, and electric units. Coincineration of sludge and refuse is discussed briefly but

any mention of coincineration of industrial sludges and other wastes in rotary kiln incinerators is relegated to another chapter.

The distinctions among properties of industrial sludges (Chapter 10) is admirable. The cross section of selected sludges is generally good with the possible exception of water treatment sludges which suffers slightly in focus because of the absence of an immediate companion section on biological sludges with associated phosphorus removal, which apparently contrast in being less bulky and more easily dewatered.

Ultimate disposal of sludges (Chapter 11) follows logically and is an important consideration in view of increased quantities of sludges being generated from wastewater treatment and air pollution control facilities. Both transportation and land disposal are well covered, but ocean disposal is shorted and deep well disposal is completely ignored.

The last two chapters could have been better coordinated or combined. The direction of current research and future developments (Chapter 12) is useful for completeness and the basic outline is complete except for energy/material recovery which is strangely hidden or downplayed throughout the book while the emphasis is on destruction and disposal. It is commendable to inject a flavor for the impact of regulations. To say that law and regulation are "absolute necessities" and that response to this driving force is "overwhelmingly positive," however, is a bit strong.

There is also somewhat of a tendency to cast excessive concern toward generalities such as "biorefractory" organics, "toxic" metals, and "pathogenic" organisms in sludges when these do not merit such attention in most sludges. Avoiding the use of the word "incineration" in the limited context of implying only thermal destruction is commendable, since many commercial thermal conversion processes produce or recover energy and materials. The coverage of environmental considerations (Chapter 13) is a bit of a misnomer in that most of the ensuing discussion is limited to generalities of environmental impact statements with no discussion of either the Clean Air Act or the Clean Water Act and related specific constituents of sludges which are of much greater importance to treatment facilities. It is unfortunate and rather inexcusable that coverage of the Resource Conservation and Recovery Act is of 1977 vintage. The RCRA impacts sludge treatment more than any other law yet this publication is already four years out-of-date.

Overall, there are slight but fortunately minimal tendencies toward the use of jargon, such as "polymers" (water-soluble polyelectrolytes or insoluble structures?), "heavy" (toxic?) metals, "dosage" (concentration?), and "pitting" (deposition in pits, not corrosion or confrontation!). The addition of a small glossary of terms would have been helpful, although mathematical terms are adequately explained as they appear, and unit conversion factors are provided. The tables are very readable and the illustrations are of good quality.

Sludge Treatment generally lives up to its promotional abstract from a purely technical viewpoint. Its shortcomings are limited to the use of rather dated cost figures throughout and a failure to in-

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clude more current regulatory actions which should have been attempted in proof. Overall, *Sludge Treatment* should provide a useful reference to professionals in the field for design purposes.

Plastic Theory of Structures

Reviewed by John A. Lepore, Chairman of the Department of Civil and Urban Engineering, University of Pennsylvania, Philadelphia, PA. Member of ASTM.

REFERENCE: Horne, M. R., *Plastic Theory of Structures*, Pergamon Press, Elmsford, NY, LC No. 78-40605, 1978, 182 pages, Hardcover, \$15.00 and Flexicover, \$8.00

This book is an excellent presentation of theory and application of plastic theory of steel structures. The book is a suitable text book, from which theories and principles can be expanded. It is much more than a reference book, in that it presents ideas and theories rather than formulas. The audience for which it is intended seems quite broad—it includes students, laboratory personnel, and field workers.

The material is a presentation of the state of the art versus plastic design theory and addresses all relevant areas of the subject. It is concisely written and very well organized. The problems presented at the end of each chapter help to bring out, clearly, the principle involved.

Summarizing, this is an excellent book on plastic theory of structures. It is ideally suited for adaptation as a class text or as a reference book for field engineers. I consider this text a classic in the field.

Ferroalloys and Alloying Additives Handbook

Reviewed by A. T. Peters, Senior metallurgist, Inland Steel Co., East Chicago, IN. Chairman of ASTM Committee A-9 on Ferroalloys and Alloying Additives.

REFERENCE: Deeley, P. D., Kundig, K. J. A., and Spendlow, H. R., Jr., *Ferroalloys and Alloying Additives Handbook*, Shieldalloy Corp., Division of Metallurg Alloy Corp., Newfield, NJ, 1981, 128 pages, \$25.00.

The art of adding a necessary alloying element to steel, manganese, is almost as old as Bessemer steelmaking—over 120 years. Alloy steels, including stainless grades, came into use before World War I; yet very little was written until the 1960's on the vital art and science of using ferroalloys and other additives to bring the molten iron or steel to the required chemical analysis. The predominant subjects discussed since then were the more commonly used alloying elements, manganese, silicon, chromium, vanadium, and so forth.

Recently ASTM Committee A-9 on Ferroalloys and Alloying Additives held a symposium to discuss the general aspects of alloy usage and to review the less well known elements. The report of the

symposium was issued by ASTM as *Ferroalloys and other Additives to Liquid Iron and Steel*, STP 739.

There is really no comprehensive text on the subject, although Deeley gave a very complete and well interpreted list of references during the mentioned symposium. Hence it is salutary that Shieldalloy Corp. and Metallurg Alloy Corp. sponsored the updating of their previous text, published in 1961, *Constituent Elements in Steel and Cast Iron*.

The new book is up-to-date, very practical, including the effects of the many technological advances that have occurred over the past 20 years, such as the argon-oxygen process, external desulfurization, sulfide modification, and so forth. Manufacture of the alloys, a rather different and highly specialized subject, is not included.

The text is arranged alphabetically by element, from aluminum through zirconium; each element is discussed in logically following subchapters, starting with "General" (importance, availability, and so on) followed by "Available Forms," that is, ferroalloys and other materials. The authors quite impartially describe the products of the sponsoring and competing companies without using tradenames. In "Addition Practices" the manner of usage is discussed but the usual metallic recoveries of the element are seldom quoted; while these vary somewhat depending on processes and practices used, general figures would be useful to nonspecialist readers.

These subchapters are strongly supported by the two final tables, the first showing the true and bulk densities and expected friabilities of the alloys and other additives, the second the thermal effects of adding them to liquid steel or iron. Fortunately for the busy engineer looking for quick answers, the tables list not only common alloys but also a number of proprietary products by their tradenames.

It is a remarkable coincidence that, obviously responding to an existing need, ASTM STP 739 contains very similar tables, the data having been assembled by two independent groups of authors.

The subchapters "Rolling and Forging" discuss the effects of the addition, singly or in conjunction with other elements, on formability and metallographic changes occurring during shaping; "Heat Treatment" present the effects on transformations and thus imply recommendations for successful processing. "Applications" indicate the usual alloy content levels in irons and steels for various, including quite recent, products and their roles, without going into details available from standard texts and product catalogs.

The book discusses even uncommon additives, for example, bismuth, and elements never intentionally added to iron or steel, for instance arsenic and hydrogen. Discussion of their deleterious effects is a welcome rounding off of a text dealing with benefits of alloying; after all, as an example, a perfect chemistry alloy heat may be ruined by sloppy hydrogen prevention practices.

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One inconvenient aspect of the layout, to which the present reviewer might have contributed by not having noticed it while reading the original draft, is the incorporation of good general information about steelmaking and alloying in the chapter called "Oxygen." Oxygen is never added to steel or iron although its content must be, and is, controlled. The oxygen level grossly affects the metal recovery from almost all additives and controls the steel type, hence the general application of the steel; however, it is not a

problem in the almost oxygen free irons. The entire chapter "Oxygen" with its many useful graphs really serves as an introduction to all the other elements and should be placed at the front of the book; any reader not familiar with steelmaking should read it first.

This is a useful book that fills a real need, interesting to the iron and steel founder, steelmaker, purchasing agent, roller, forger and heat treater, and development engineer and designer. A good list of references is handy for any further study.