
BOOK REVIEWS

Heat and Mass Transfer in Metallurgical Systems

Reviewed by D. M. Kundrat, Research engineer, Raw Materials and Ironmaking, Research and Technology, Armco Inc., Middletown, OH.

REFERENCE: Spalding, D. B., and Afgan, N. H., *Heat and Mass Transfer in Metallurgical Systems*, Hemisphere Publishing, Washington, DC, 758 pages, \$85.00.

The title, as it appears on the cover of the book and in the various advertisements, suggests that it is a work by two authors, rather than a collection of papers, with practically no editorial comment. I am suggesting that it may have been more appropriate to entitle the book "Topics in Metallurgical Heat and Mass Transfer—1979 Seminar of the International Centre for Heat and Mass Transfer by D. B. Spalding and N. H. Afgan, Editors."

On the whole, most of the papers presented are rigorous in the application of the principles of heat and mass transfer. In several of the papers, these principles have been extended into new areas. However, the range of topics treated from the field of process metallurgy is, in fact, very broad. On the one hand, one could find a paper relating to almost any topic at the forefront of research in this field, from modelling of ferrous and nonferrous extractive processes to fluid dynamics and crystallization to problems in nuclear reactors and turbines. In this regard, this is a valuable reference book. On the other hand, it is perhaps because of this very broad range of topics that the book lacks unity. An editorial comment and a good review paper introducing the thrust of the book in each section could have improved the coherency of the book.

Also, the book could have been better organized by grouping many of the papers together, which are mainly theoretical in nature. In this broad grouping, I would include many of the papers from the sections "Metallurgical and Fluid Dynamic Processes" and "Heat and Mass Transfer During Crystallization," and a few papers from the section "Heat and Diffusion Treatment." These papers would then be subgrouped according to the following sections: "Fluid Mechanics," "Solidification Processes," "Heat Transfer," and "Diffusion." In turn, the papers that are concerned mainly with application of theory to solving specific problems in the plant could be grouped in another broad section, with each process treated in separate subsections, for example, "Blast Furnace," "Injection Metallurgy," "Aluminum Reduction Cells," "Ingot Solidification," and so forth.

Finally, it is obvious that many of the papers have not been proofread. Poor grammar and spelling and omitted words are widespread, particularly in the papers by foreign authors, some of which have made outstanding technical contributions in their papers. Clearly, it is the responsibility of the editors to avoid such embarrassment.

The least acceptable effort would have been for the editorial staff to have proofread the papers and returned them to the authors for corrections in the original type print. Nonetheless, it is difficult to understand that, for the price of the book (listed for

\$85), the articles could not have been retyped in the same format. At this price, the reader is entitled to more than a collection of preprints!

Corrosion of Nickel and Nickel-Base Alloys

Reviewed by T. S. Lee, Marine Corrosion Section Manager, LaQue Center for Corrosion Technology, Inc., Wrightsville Beach, NC; Vice-Chairman of ASTM Committee G-1 on Corrosion of Metals.

REFERENCE: Friend, W. Z., *Corrosion of Nickel and Nickel-Base Alloys*, Wiley-Interscience, New York, 1980, ISBN 0471-28285-5, 459 pages, \$39.95.

This volume is part of The Electrochemical Society's Corrosion Monograph Series. This Series is being prepared by specialists with the intent of updating the corrosion literature in each field. Other monographs in the Series include: *The Corrosion of Copper, Tin and Their Alloys* by Leidheiser, *The Corrosion of Light Metals* by Godard et al, *The Stress Corrosion of Metals* by Logan, *High-Temperature Oxidation of Metals* by Kofstad, *Handbook on Corrosion Testing and Evaluation* by Ailor, *Corrosion in Nuclear Applications* by Berry, *Marine Corrosion* by LaQue, *Passivity of Metals* by Frankenthal and Kruger, and *Corrosion of Stainless Steels* by Sedriks.

The purpose of the present monograph is clearly stated in the Preface as being "to summarize in one volume much of the useful information concerning the corrosion-resisting properties and limitations of the group of high-nickel materials which includes commercial nickel and nickel-base alloys." The author successfully achieves his objective by presenting a well-organized treatise on the subject. The resulting reference volume provides an excellent basis for the engineer to evaluate the relative merits of this class of materials for applications in corrosive environments.

The author informs the reader in the Introduction about the degree of basic understanding of corrosion phenomena that is required for optimum utilization of the data in the book. Several text books are referenced for the corrosion novice to use. The brief review of the basic concepts of corrosion, which is provided in the Introduction, does provide the reader with some elementary orientation in the subject area.

Also in the Introduction, the author explains the basic organization of the book by the different classifications of commercial nickel-base alloys:

- (1) commercially pure nickel materials,
- (2) nickel-copper alloys,
- (3) nickel-chromium alloys,
- (4) nickel-iron alloys,
- (5) nickel-molybdenum alloys,
- (6) nickel-chromium-molybdenum alloys,
- (7) nickel-chromium-molybdenum-copper alloys, and
- (8) complex nickel-base alloys known as superalloys.

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He explains the decision to use trademark alloy designations and provides a source list for these trademarks. This is an extremely useful feature of the book in that it applies readily recognized trade names in lieu of chemical compositions of the specific alloys. This enhances the readability of the text and eliminates the constant referral to a table of alloy compositions to determine the identification of a given alloy. Perhaps the only deficiency in this area is the lack of any reference to standard designations, such as the Unified Numbering System. While this may not have been possible for every alloy, it would still have provided a basis for documenting standard alloys for which only proprietary designations are given.

The individual chapters on classes of alloys generally are organized in a logical fashion. An introductory section on electrochemical properties provides some insight into the nature of the corrosion-resistant properties of each class of alloys and some indication of the relative contributions to these properties by the major alloy constituents. In several instances, however, this section deviated into discussions about general corrosion behavior in specific environments that were subsequently covered in the chapter. This tended to somewhat disrupt the organization and flow of the narrative.

Following the electrochemical discussions, a brief review of the alloys to be covered in the chapter is provided. This includes tables of nominal compositions. The data are subsequently presented through discussion of behavior of the alloys in specific corrosive environments. This also provides the key to organization of the index. In general, the organization of the data by alloy classification and corrosive environment provides a very useful reference mechanism for the engineer desiring specific data.

The data are typically presented in a noncontroversial fashion. Results of specific tests are documented and salient details are provided about the critical test parameters. This is important in that it allows the more experienced reader to exercise his own judgement regarding the merits of the data or the relevance to some related application. It is necessary, however, to pay close attention to the corrosion rate units which are used in the tabular and graphical data. While mils per year are used in the majority of cases, the infrequent use of other units, such as inches per month, inches per year, and mils per month, could lead to erroneous interpretations.

Perhaps the most serious criticism of the book stems from the dates of the references. Nearly half of the references in the text date from before 1960. Only 12% of the references are from work published since 1970 and one fourth of these are included in the final chapter on superalloys. While it is recognized that the publication process can be long and arduous, the copyright data of 1980 implies a currency of information that is not necessarily merited. The use of older, classic references was imperative in the effort to consolidate information in this subject area for the first time. However, an updated edition of this text may be warranted in the near future.

Overall, the text is highly recommended as a reference source which can be relied upon for technical accuracy. It should prove to be a very useful tool to the engineer responsible for selecting materials for corrosive environments.

Ferrous Production Metallurgy

Reviewed by P. A. Speer, Inland Steel Co., Chicago, IL. Chairman of ASTM Subcommittee A01.02 on Structural Steel for Bridges, Buildings, Rolling Stock, and Ships.

REFERENCE: Peters, A. T., *Ferrous Production Metallurgy*. Wiley, New York, 1982, ISBN 0471-08597-9, \$47.50.

This narrative is intended by the author for the use of undergraduate college students and also for men and women working in the basic steel industry. It describes the raw materials used in the manufacture of iron and steel, plus methods of processing from pelletizing iron ore and sintering through coke, iron, and steel production. The basic open hearth, basic electric arc, and basic oxygen processes have each received a full chapter's coverage. The production of high alloy steels via the argon-oxygen decarburization (AOD) process and vacuum degassing are explained. Semi-finished processes of primary mill rolling of ingots and strand cast are also discussed.

In those areas in which few innovations have occurred in recent years, the presentation would be termed a survey of existing knowledge, but it also treats relatively new subjects for the industry such as ladle metallurgy. Pollution control and energy considerations are also presented. For the subjects discussed, the presentation is sufficiently thorough (finishing mill operations are not discussed).

The author has an unusual knowledge of European practices and blends them well into an experience in the United States which exceeds 25 years.

While the reviewer shares the author's concern about the lack of comprehensive up-to-date text books in ferrous metallurgy and the diminished number of students interested in the steel industry, it is felt that this book will be of greater value to individuals already working in the steel industry than as an undergraduate text. The book does not contain advertising or promotional material and supplies proper credit for information sources not of the author's own knowledge. The tables are comprehensive and will require study to fully absorb. In some areas, less detail might have been included, but had that occurred it would have reduced the value for those who will use it to study areas in which they work. The text includes numbered divisions and subdivisions. This makes not only the Index but also the Table of Contents useful for locating specific subjects.