

Welding Metallurgy, 2nd Edition

Sindo Kou

(John Wiley & Sons, Hoboken, New Jersey, 2002)

480 pages, \$125.00

ISBN 0-471-43491-4

The development of welding has an incredibly long history, perhaps beginning with the hammer welding of gold. Although many aspects of welding remain entirely experimental, there is no doubt that enormous strides have been made to qualify the subject as a partial science. Sindo Kou has played a role in the genesis of this science; at the same time, he is an experienced teacher. These qualifications make him well suited to compose what has become an essential text on welding metallurgy, now in its second edition.

The book is logically divided into four parts, the first dealing with the general aspects of fusion-welding processes, and the remaining three with the metallurgical zones encountered in a *weldment*, that is, the fusion, partially melted, and heat-affected zones.

Kou has implicitly managed to cover both the science and technology of welding. A good example is the treatment of fluid flow in the fusion zone, where there is a rigorous description of the mathematical and physical modeling of the weld-pool shape. Associated complications, such as the need to empirically account for turbulent flow, and the lack of consensus about the mechanism by which activated fluxes influence weld penetration, are also discussed.

This approach is further evident in the initial discussion of welding processes, where the advantages and shortfalls of each process are meticulously listed, including a consideration of the capital costs of equipment.

There are many cases in which the book has been enhanced with the latest research. It is now widely realized that methods such as the DeLong diagram for predicting the weld ferrite content are severe approximations, assuming linear behavior and neglecting the effects of the cooling rate. There is, therefore, a nice discussion of the neural-network approach to this problem. The discussion of weld microstructure is also an improvement on the previous edition, with significant space devoted to the variety of transformation products in low-alloy steel welds, which, after all, form the majority of welding consumables.

Each chapter has a complete set of references, suggestions for further reading, and a set of problems. The latter are interesting in that some of the problems cannot be

answered simply by reading the book—they require instead a degree of deductive reasoning. Quite refreshing!

I would suggest that, in a future edition, the book should include more than the current single paragraph on friction stir-welding, a process which is now revolutionizing the joining of critical components made from aluminum and its alloys. Spot welding should also have a presence, given its importance in automobile manufacture.

The book is well produced and is meaningfully illustrated. If there is one slight irritation, it is the fact that the book, like much of the U.S. welding literature, frequently ignores the SI convention on units. But my overwhelming impression is one of admiration for a task well executed. The book is undoubtedly a source of reliable knowledge.

Reviewer: Harry Bhadeshia is a professor of physical metallurgy at the University of Cambridge.

Handbook of Radical Polymerization

Krzysztof Matyjaszewski and

Thomas P. Davis, Editors

(Wiley InterScience, New York, 2002)

936 pages, \$200.00

ISBN 0-471-39274-X

This book consists of 16 chapters by leaders in the field of free-radical chemistry and radical polymerizations. Its usefulness is enhanced by a subject index. As the name implies, the book provides thorough coverage of the field and includes chapters on the fundamentals of radical chemistry; the chemistry of radical polymerization, including kinetics and copolymerization; and a range of specialized radical-polymerization techniques, especially living radical polymerizations. This book will be of use to both industrial and academic scientists working in the field. Selected sections of the book, or even the entire book, would constitute excellent material upon which to base advanced courses on radical polymerization in general, or a more specialized course, for example, on living radical polymerization. However, there is enough background provided at the beginning of the book that it will also be useful as a text for introducing a novice with undergraduate chemistry training to the field.

The chapters are uniformly excellent, and the quality of production is obvious throughout the book, especially in the figures and reaction schemes. I was especially pleased to see a chapter on experimental procedures and techniques for radical polymerization, including various homogeneous and heterogeneous conventional polymerizations and various

living/controlled polymerizations. This sort of information is all too often not included in such a handbook, but it will be useful to many readers. Indeed, this material could form the basis of a laboratory component that could accompany a lecture course based upon this book. The unusually thorough and up-to-date referencing is also a major plus.

In summary, I give this book my highest recommendation. On the back cover of the book it is stated that the *Handbook of Radical Polymerization* is guaranteed to have a long shelf life. I suspect that this will be true. However, I also believe that it is a book that will be so useful to its readers that it will spend little time on the shelf!

Reviewer: Jimmy Mays is currently a UT/ORNL Distinguished Scientist in the Chemistry Department at the University of Tennessee and in the Chemical Sciences Division at Oak Ridge National Laboratory. He has conducted research in the polymer area for 25 years.

Principles and Applications of Ion Scattering Spectrometry: Surface Chemical and Structural Analysis

J. Wayne Rabalais

(John Wiley & Sons, New York, 2002)

336 pages, \$94.95

ISBN: 0-471-20277-0

This book is based to a large extent on the experimental expertise of J. Wayne Rabalais and of his co-workers at the University of Houston, Texas. The title of the book is a short abstract, and the book fulfills the expectations of the reader. Ion beams are in widespread use for analysis and materials modifications by implantation or sputtering. A discussion of materials modification includes the treatment of tumors, whereas we intend to think of semiconductor devices only. The energy range of the ions in use extends from 100 eV to the MeV region. The region is rather well defined by the onset of diffraction processes at the lower end and by the onset of nuclear reactions at the upper end. Within this region, the principles of ion-atom or ion-solid interactions are all the same and, in a way, simple. These principles are well described in the second chapter of Rabalais's book.

This chapter is preceded by a pedagogical chapter on the usefulness, the implications, and generalities of ion beams. Chapter 1 contains overview figures that are very useful for teaching or as introductory figures for review articles, and, of course, for the book itself. The chapter includes some historic remarks and a well-selected list of references. Here, it is also made clear that the aim of the book is restricted to a limited

range of ion-beam energies from a few hundred eV to ~10 keV.

Nevertheless, Chapter 2 is of general interest and the description of the theory of ion-atom scattering goes into all of the necessary details such as the *time integral* and the generalized *deflection function*. The chapter includes good examples for the scattering potential with a detailed discussion of the pertinent screening functions. Included is also a thorough description of the channeling and blocking effects—again, a useful source for students, teachers, and researchers in the field of ion-beam applications in any energy range. These theories and models are available in the literature but rarely found well-ordered in one place. A short, well-selected list of references concludes the chapter.

While each chapter ends with a restricted number of references, the end of the book provides a long “Bibliography of

Ion-Scattering Publications.” The list is ordered alphabetically by authors, so readers may find themselves, their friends, and, well, their “un-friends.”

With Chapter 3, the author enters into the hardware world of low-energy ion scattering. This chapter is a little masterpiece of its own, reflecting the long experience gathered at the University of Houston, which is a place of excellence in the development and application of instruments in actual use. There are two kinds of instruments; some do work.... The instrumentation includes straightforward particle detection, single-particle counting, numerical acquisition of signals, analyzer transmission functions, detector properties, and—most important—the use of microchannel plate detectors for structural analyses.

Chapters 4–7 contain examples of the applications in chemical and structural

analysis. These are well discussed, and the figures are based on original experimental data and explained by understandable models. The final two chapters may be of interest for researchers in the field only. They provide a precise description of the state of the art of charge-exchange processes, inelastic losses, and hyperthermal-reactive ion scattering.

In summary, the book is highly recommended for physicists or students involved with teaching or research concerning ion beams.

Reviewer: Werner Heiland is a professor for experimental physics at the University of Osnabrück, Germany. His research interests focus on the structure of surfaces explored by ion beams and scanning transmission microscopy and the interaction of ion beams with solids and solid surfaces concerning charge-exchange and energy-loss processes.



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