

## BOOK REVIEWS

### **Synthetic Membrane Processes: Fundamentals and Water Applications, a monograph on water pollution**

Edited by Georges Belfort, Academic Press, 1984, 552 pp.

Chapters 2 through 6 make a good summary of the theory of membrane transport through reverse osmosis, ultrafiltration, and electrodialysis membranes, and discuss some of the issues in modeling devices using the membranes. This section is particularly useful in a textbook sense for teaching principles to chemical engineers. Chapters 7 through 13 provide a series of case studies based on water and wastewater treatment. A large body of practical information is provided (such as cleaning and pretreatment methods).

There seems to be relatively little connection between the two parts (Chapters 2-6, and 7-13) of the book, perhaps because of the number of authors involved (14 within the U.S., 9 outside the U.S.). The theory presented in Chapters 2 through 6 does not always find illustration or application in the latter chapters.

Ultrafiltration as applied to macromolecular (biopolymer) separations and purification is not covered at all. Nor are membrane processes for gas separation or enrichment. Water is the product of central focus.

The list of references is extensive, up to date, and broad, reflecting the international background of the contributors.

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### **Fluidization '85: Science and Technology**

Edited by Mooson Kwauk and Daizo Kunii, Science Press, Beijing, China; Elsevier, Amsterdam, 1985, 488 pp.

This is a collection of forty contributed papers, three invited papers, and two overviews presented at the Second China-Japan Symposium on Fluidization, Kuming, China (April 10-15, 1985). The coverage of the field is wide, as can be seen from the titles of the sections into which papers are grouped, namely Flow-1

(Bubbling Beds), Flow-2 (Others), Liquid-Solid and Three-Phase, Combustion and Gasification, Catalysis and Solid Processing, Modeling, Mass and Heat Transfer, and Measurement.

Many of the papers reflect concerns common to most workers in the field—bubble properties, gas exchange between bubbles and the emulsion phase, the transition to slugging, the influence of distributor design, etc. However, particularly interesting are a few contributions that describe less conventional fluidized systems, such as the vibro-inclined fluidized bed, the jigged bed reactor, and multi-stage fluidized beds of various types. There is a strong set of papers on liquid fluidized and three phase beds, but a curious lack of papers on particle transport, with the exception of a review on standpipe flow from a western source, which is listed but not reproduced.

One of the more interesting contributions is the overview "Challenges in Fluidization," by Kwauk and two co-workers, which provides an excellent survey of areas where research is still needed and urges more attention to situations other than the conventional bubbling fluidized bed.

The reviewer believes that the frequency with which symposia on fluidization are currently held is far too great, with the consequence that only a small proportion of contributed papers contain much of value. By comparison with other recent symposia, the present one is better than average in this respect, so there is something to be said for making space on a bookshelf for this collection.

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### **Adsorption and Catalysis on Oxide Surfaces**

Edited by M. Che and G. C. Bond, Elsevier, 1985, 442 pp., \$94.50.

This volume contains the proceedings of a symposium held to commemorate Dr. A. J. Tench, who made major contributions to the knowledge of the structure, reactivity and adsorption properties of ox-

ide surfaces. It has succeeded in bringing together, as authors of the various chapters, the major practitioners in the field of oxide characterization, surface and bulk, and catalysis of oxide surfaces. As a result, the volume contains an up-to-date review of the state of oxide surface science characterization and several papers on catalysis over oxide surfaces.

Most researchers in the field of surface science and catalysis concentrate on metal surfaces. The surface science and catalysis of metals have been highly developed and many high-technology catalysts were developed from this knowledge base. The studies of oxide surfaces are not so well developed. This particularly brings into focus the importance of such a volume that concentrates on the developing science of these catalytic materials. The volume represents research that is state-of-the-art. Many of the papers discuss the use of various techniques. A combination of these techniques for the characterization of oxide, bulk and surface, point out the difficulties of such studies and the interpretation of their results. Over half of the papers deal with characterization and do not mention catalytic studies. However, the other papers clearly show the unique catalytic properties of oxide surfaces for partial oxidation and also for the production of alcohol from carbon monoxide and hydrogen. In this respect, the catalytically important materials are the focus of these studies. These include molybdenum oxide, vanadium oxide, magnesium oxide, and the important alumina silicate molecular sieves.

At this stage of development of oxide structural and catalytic chemistry, there are no overriding principles that could be used to focus the work at present and extrapolate to the future. The results are scattered and the book clearly reflects this fact. However, each chapter is written by an authority in the field, and professionals working in the area would find it particularly useful because of its state-of-the-art account of the understanding of the structure and adsorption characteristic of oxide surfaces. In some cases, these physical properties are related to catalytic activity. The book will make an excellent addition to the library of sci-

tists and technologists working in the field of oxide chemistry and catalysis.

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### **Interfacial Phenomena. Equilibrium and Dynamic Effects**

By Clarence A. Miller and P. Neogi, Marcel Dekker, 1985, 354 pp., \$69.50.

This book is Volume 17 in the "Surfactant Science Series," familiar to any researcher in interfacial phenomena. Unlike most of its predecessors in this series, this volume is written as a textbook.

*Interfacial Phenomena. Equilibrium and Dynamic Effects* is the first book in the field written by chemical engineers specifically for chemical engineering applications of colloid and surface chemistry. As a result, it contains a significant amount of material previously unavailable in a single volume, treated in a unified manner. Furthermore, much of the basic material is presented more rigorously than in traditional references and texts in interfacial phenomena.

The first four chapters are an introduction to the principles of interfacial phenomena. Chapter 1 covers the fundamentals of interfacial tension. The concept of interfacial tension is derived scrupulously using both thermodynamics and mechanical approaches. This concept is extended to applications including shapes of interfaces, measurement of interfacial tension and adsorption. A particularly unique feature of this chapter is the inclusion of a discussion of the Cahn and Hilliard approach to calculating interfacial density and concentration profiles. Chapter 2 continues along the same lines, covering wetting and contact angle phenomena. Both molecular and empirical approaches are included. Once again, material unique to this text is included covering contact angle hysteresis and density profiles in liquid films.

Chapters 3 and 4 are a basic introduction to colloids and surfactants, respectively. The chapter on colloids only covers particle interactions in detail, immediately moving to discussions of colloid stability and coagulation. The section on polymer stabilization of colloidal dispersions is somewhat unique to texts in this area. Conspicuously absent is significant treatment of electrokinetic phenomena. The chapter on surfactants briefly covers some chemistry of surfactants and one

model of micellization thermodynamics. The majority of the chapter is devoted to other patterns of association such as microemulsions, liquid crystals and surface films, some of which represents material not treated in other texts.

Chapters 5-7 cover interfacial transport phenomena, and really set this book apart from all others in this field. Interfacial conservation equations are derived, and their application to problems in interfacial stability is emphasized. In particular, an entire chapter is devoted to interfacial stability and wave motion, using linear stability analysis. This chapter is very readable since the discussion is limited to the prototypical instabilities that give physical insight without excessive mathematical complexity. A second chapter covers instabilities caused by heat and mass transfer, including the familiar Marangoni instability. Brief discussions of nonequilibrium interfacial tension, and the effects of chemical reaction and spontaneous emulsification are also included. The third chapter briefly covers a variety of other problems in interfacial transport including surface rheology and dynamic contact lines.

In reviewing a book such as this, the goals of the authors as well as the utility of the book to the interdisciplinary audience to which it must appeal should be considered. The authors have written this book to give a brief introduction to interfacial phenomena with significant emphasis on the nonequilibrium aspects. In this sense, they have been successful. Any chemical engineer with knowledge of transport phenomena could learn the principles of interfacial phenomena from this book. Anyone with previous knowledge of colloid and surface chemistry could do the same, although some knowledge of transport phenomena might be a useful prerequisite. The physical explanations that encompass the analysis are uniformly excellent. The reader desiring to learn the material in detail, particularly that on interfacial dynamics, will want to keep a paper and pencil handy to insert missing steps in the derivations, not always a trivial exercise in this book. The reader doing this will find very few errors in the equations, all of which are obvious. The same applies to the descriptive material. Readers seeking more depth on particular topics will find ample references to other texts and the research literature. In summary, the practicing engineer or scientist in colloids and surfaces should

consider this book essential as a reference.

Finally, the utility of this book as an instructional text should be considered. Students may find the presentation somewhat terse compared to other textbooks, and many of the problems are quite challenging both intellectually and analytically. For a one-semester course emphasizing interfaces and interfacial transport, there is no better text available. For a course on colloids, this book is unsuitable. For a one-semester survey course covering both interfaces and colloids, such as that taught by this reviewer, the book can still be used as long as it is supplemented with material on colloid science and colloid transport. While the price may seem high for a textbook, the publisher does offer almost a 40% discount on orders of at least five copies for classroom use.

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### **Handbook of Energy Systems Engineering**

Edited by Leslie C. Wilbur, Wiley Series in Mechanical Engineering Practice, 1985, 1,775 pp., \$74.95.

According to the publisher, this volume "is a rich sourcebook of reference data and formulas, performance criteria, codes and standards, and techniques used in the development and production of energy." Material was "chosen for its optimum usefulness and applicability to the field of energy engineering."

The Publisher's advertisement is a fair summary of this comprehensive handbook that will be of special use to practicing engineers with prior familiarity with any of the many subjects for which this reference volume serves as a source of quantitative data. The book is not meant to be and is not suitable as a textbook on energy engineering.

The book contains the following information: demographics (energy demands, consumption, prices, and sources); energy use for conservation, heat utilization, storage, transportation, and cogeneration; energy utilization laws and principles (thermodynamics, heat transfer, thermophysical properties, and fluid mechanics); energy systems technology (pumps, fans, valves, piping, lubrication, instrumentation and controls, compressors, cooling systems, water treatment,