BOOK REVIEWS

The Engineering of Chemical Reactions

By Lanny D. Schmidt, Oxford University Press, New York, 1998 536 pp., $75.00.

Professor Schmidt has made an important contribution to the chemical engineering profession with the publication of his textbook on chemical reaction engineering. The book breaks new ground in two important ways. First, it fully integrates analyses of industrial reactions and reactors into the presentation of fundamental principles of reaction engineering. Secondly, it includes a substantial treatment of chemistry and chemical kinetics, which is lacking in most undergraduate reaction engineering texts.

By incorporating descriptions of industrial reactions and reactors into a text on chemical reaction engineering, Dr. Schmidt has successfully combined the qualitative material that traditionally had been presented in courses on "Industrial Chemistry" with the rigorous mathematical analyses traditionally presented in courses on reaction and reactor engineering. The traditional reaction engineering analyses benefit from the practical examples, and the rationale behind industrial processes becomes more apparent to students when the designs are subjected to reaction engineering analyses.

Chemistry and chemical kinetics are incorporated into the text through many examples, and the traditional focus on single step, elementary reactions ($A \Rightarrow B$) is replaced by more realistic exampls. The variety of topics covered is impressive, ranging from petroleum refining and chemical manufacturing to biotechnology and environmental chemistry.

Although the text is innovative, instructors will find the organization familiar. After an introductory chapter (Chapter 1), the text begins with a treatment of reaction rates and batch reactors (Chapter 2). This is followed by the traditional treatment of continuous, stirred-tank reactors, and plug-flow, tubular reactors in Chapter 3. Chapter 4 covers complex reaction networks, and Chapter 5 covers nonisothermal reactors. Each of these chapters includes descriptions of relevant industrial processes.

In Chapter 6, Dr. Schmidt presents multiple steady-state and transient behavior. In most reaction engineering texts, this material is relegated to a chapter on specialized topics. Schmidt, however, makes a convincing case for the importance of heat management in reactor design, justifying the prominence given to this highly mathematical material. Chapter 7 concludes the presentation of reaction engineering fundamentals with a discussion of catalytic reactors and mass transfer.

Chapters 8–12 deal with specific applications, including bioreactors, environmental modeling, reactions of solids, combustion reactions, reactor safety, polymerization reactions, and multiphase reactors. These chapters are designed so that the instructor may choose to present any or all of the material.

The text is written in a very readable style. The problems at the end of the chapters are numerous, and involve both analytic and numerical solution procedures. The problems requiring extensive computation are written in a manner such that they can be solved using any of a variety of software packages, and an Appendix provides introductory material for a number of common equation solvers. My only quibble with the text is the referencing procedure. The references are collectively presented at the end of the first chapter, and are not cited individually. This may make it difficult for instructors to present more detailed analyses of the industrial technologies presented throughout the book. Overall, however, Dr. Schmidt has created a wonderful text. He has weaved the fundamentals of chemical reaction engineering together with the history and practice of chemical manufacturing. The result is a new direction and a new standard for chemical engineering texts.

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Rheology of Polymeric Systems, Principles and Applications

By P. J. Carreau, D. C. R. De Kee, and R. P. Chhabra, Hanser/Gardner Publications, Cincinnati, OH, 1997, 520 pp., $197.50.

This book is an extended compilation covering many topics that are somehow (that is, more or less directly) related to polymer rheology. In other words, the book does not focus on any specific aspect of rheology, and, rather, attempts at covering them all. Thus, although the book lacks in depth, it contains, altogether, many pieces of information not readily available in other books with similar titles. It should also be clear that the book is written by chemical engineers and is directed to chemical engineers, in the most traditional fashion. That is to say, the modern approach to polymer rheology taken mostly (but not exclusively) by theoretical physicists is not followed in this book.

After a generic introduction in Chapter 1, the second chapter starts with the definition of material functions and goes on with an extended list of constitutive relationships for the viscosity in steady shear, many of which were contributed by, and named after, one or more of the authors. Chapter 2 ends with a discussion on the effect of temperature, pressure, and molecular weight on shear viscosity. Here, what had been a regular and smooth chapter ends in a somewhat surprising way. Indeed, to explain the famous 3.4 power law of η vs. M in the entangled state, the authors choose to refer to an old argument by Bueche (1952), which, unfortunately, happens to be wrong. The authors seem to ignore completely (at least here) well-known modern concepts like reptation and tube length fluctuations.

Chapter 3 on rheometry is standard as far as shear flows are concerned. We find the capillary, concentric cylinders, cone-and-plate, and concentric disk geometries. There is also a brief section on yield stress determination, while elongational flows are not considered in this chapter. A short discussion on elongational measurements can be found in the previous chapter in con-