BOOKS

Chemical Reactor Design and Operation

By K. R. Westerterp, W. P. M. van Swaaij, and A. A. C. M. Beenackers, John Wiley & Sons, 1984, 767 pp., $100.00.

This book is a revised edition of *Elements of Chemical Reactor Design and Operation,* which appeared in 1963 and was "sold out in two years." Because of the rapid advances in the field, the new edition contains over twice the volume of the first, which is, of course, reflected in the cost.

The book provides a combination of theory and practice. Practicing engineers should find it useful in that it contains numerous worked illustrative examples, all of which are based on the authors' extensive industrial experience. Unfortunately, however, it contains no problems for students to work out on their own.

The book is well written and not difficult to understand. Most of the material in it could be taught to undergraduate students as well as beginning graduate students. Knowledge of the multidimensional equations of change or of vector notation is not required or utilized.

The authors are meticulous in their definitions of terms such as yield, selectivity, fractional conversion, enhancement factor, etc. Their notation is a compromise between European and American conventions.

There is considerable emphasis (Chapter VII) on diffusion and chemical reaction. Film theory is used extensively here, although penetration theory and surface renewal models are also discussed.

The topics covered in the book are: I. Fundamentals of chemical reactor calculations (35 pp.): material and energy balances, thermodynamics, conversion, selectivity, yield, classification of reactors; II. Model reactors (44 pp.): single reactions, isothermal single phase reactor calculations (batch and tubular reactors), cascade of tank reactors, recycle reactors; III. Multiple reactions (71 pages): parallel and consecutive reactions, autocatalytic reactions, biochemical reactions; IV. Residence time distribution and mixing (75 pages): longitudinal dispersion; V. Micromixing (32 pages); VI. Heat effects (90 pages): batch reactors, tubular reactors, multitube reactors; VII. Multiphase reactions, single reactions (163 pages): mass transfer with and without reaction, homogeneous irreversible and reversible reactions, heat effects, heterogeneous systems, measurement of mass transfer coefficients; VIII. Multiphase reaction, multiple reactions (72 pages): Type I and Type II selectivity, mass transfer in series and/or parallel; IX. Heat effects in multiphase reactors (98 pages): gas-liquid, gas-solid, and gas-liquid-solid reactors; X. Optimization of chemical reactors (75 pages): relation between technical and economic options, temperature optimization, geometric programming, Lagrangian multipliers numerical search routines, dynamic programming, Pontryagin's maxima principle.

The strong points of this book are its scope and comprehensiveness, its careful attention to precise definitions, its balance between theory and practice, and its clarity. Its weak points are its large volume of material and consequent high cost, its preponderance of older references (only a few are in the 1980's), and its lack of home problems.

In summary, the book would be an excellent handbook of chemical reactor design for the professional engineer in industry, and a very satisfactory text for undergraduate or beginning graduate students.

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Introduction to Aerosol Science

By Parker C. Reist, Macmillan, 1984, 299 pp., $38.00.

This slim monograph consists of sixteen chapters that touch on particle size distributions, aerosol particle dynamics, transport processes, electrical phenomena, nucleation, growth and evaporation, optical properties and coagulation. The emphasis is on fundamentals, and only the most elementary concepts are introduced. The book is written as a textbook, and about 10% of the volume is devoted to problem sets and numerous example problems at the end of each chapter. The worked examples tend to be trivial, consisting mostly of numbers substituted into the equations presented in the text. The mathematical treatment is kept at a level such that anyone who has taken lower division undergraduate courses in physics and mathematics should be able to follow the presentation.

The breadth of coverage of aerosol science is quite good, but the absence of a discussion of transport processes in the free-molecule and Knudsen aerosol regimes is regrettable. It would also be useful to have more information on widely used aerosol instrumentation. The two chapters on electrical phenomena (aerosol charging and electrostatics) provide a particularly lucid introduction to the subject. Chemical engineers will find the chapters on fluid properties, viscous flow and diffusion to be superficial, and the chapter on light scattering is too condensed to be very useful. Scientists who do not have backgrounds in transport phenomena might appreciate the rudimentary survey of transport processes, and it appears that the author has provided this material for students in industrial hygiene, toxicology and other nonengineering disciplines.

The aerosol researcher will find little recent literature cited, and even comprehensive reviews of evaporation and condensation processes such as Wagner's, the extensive studies of homogeneous nucleation by Katz and others, and surveys of aerodynamic drag on particles by Kasper and by Dahneke are not cited. In this respect, the recent book by Hidy is of more use to the researcher.

The printer must be taken to task, for in the copy of the book examined, the print on sixteen pages was blurred.

The book is well suited as a primer of aerosol science, for I know of no better introduction to the basic concepts. It is recommended introductory reading for my own first year graduate students.

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