BOOKS

Bubbles, Drops, and Particles, by R. Clift, J. R. Grace, and M. E. Weber, Academic Press, Inc., 1978, 380 pages, $32.00.

The authors note in their Preface that "in many senses, bubbles and drops are the chemical engineers' elementary particles." The validity of this observation has given rise to such a voluminous output of relevant publications that the preparation of this book constitutes a real service to the many workers in the field.

Attention to applications is minimal, the focus being on fundamental relationships governing fluid mechanics, heat, and mass transfer between Newtonian fluids and single, freely moving solid particles, bubbles or drops. The twelve chapters deal with shape classification for rigid and fluid particles and with the transport processes during both slow and more rapid flow relative to rigid and fluid bodies of spherical and non-spherical shapes. Extensive treatment is provided on wall effects, surface effects, field gradients, accelerated motion, and the formation and breakup of fluid particles.

The principal objective of the book, according to its Preface, "is to give a comprehensive critical review" of the relevant literature, and the authors have generally succeeded admirably. Notable features include new and improved correlations for the drag coefficient and terminal velocity of spheres (pp. 112-116), for the drag coefficient for steady crossflow past long cylinders in the range $0.1 < Re \leq 400$ (pp. 154-5), and for the terminal velocities of cylinders in gases in the "Newton's law" range (p. 156).

The breadth of coverage and thoroughness of referencing for most topics is impressive. It is surprising, therefore, that coalescence of single drops and bubbles at plane interfaces is ignored, since the subject has been widely studied from the early work of Osborne Reynolds in 1881, to the many papers by S. Hartland, S. G. Mason, and others. The omission is significant for workers in liquid extraction, gas absorption, and extractive metallurgy, among others.

The book contains neither worked illustration problems nor unsolved problems for solution by the reader. This, together with its terse, compact style of writing, renders it most suitable for reference use, as the authors intended. For this purpose, however, the present reviewer believes that it would have been significantly enhanced by the inclusion of an author index.

Recommended or preferred relationships are occasionally underspecified. For example, on p. 152 it is stated that "for axisymmetric flow at higher *Re* the most reliable data are those of Beg for the sublimation of oblate naphthalene spheroids," without mention of the fact that Beg's spheroids were supported from the rear and that his free stream turbulence intensity ranged from less than one percent to about three percent. Brown, Sato, and Sage [*Chem. Eng. Data Ser.*, 3, 263 (1958)] showed that, for an *Re* of 7000, the Sherwood number for a sphere increases by about 20% as the turbulence intensity increases from zero to 10%. Thus, if one's free stream turbulence intensity is 10%, a more reliable correlation than Beg's could well be that of Pasternak and Gauvin [*Can. J. Chem. Eng.*, 38, 35 (1960)], whose data were collected under just such conditions of turbulence.

Typographical errors are very few in this book, although the erroneous labelling of "20" on the abscissa of Figure 6.17 could perhaps cause confusion, equation (7-39) is incorrect, and the celebrated name of Roger Eichhorn is misspelled on page 229.

The drawings, printing, and binding are excellent and the book has a good 12-page subject index. It provides a valuable and authoritative review which will be indispensable to all those active in this area.

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Applied Chemical Process Design, by F. Aerstin and G. Street, Plenum Press, New York, 1978, 294 pages, $25.00.

This book provides some good precis of various unit operations without overloading the reader with theoretical buildup. The latter is both its strength and its weakness. It is an easy reference that can provide on-site answers. The material presented is adequate to solve many design and/or plant problems. Information is conveniently accessible and the emphasis throughout is to provide concise design procedures.

The authors have emphasized those areas most often encountered in chemical process design, namely heat transfer, mass transfer, fluid flow, and mixing. Other design areas considered, but to a lesser extent, include cooling towers, liquid-liquid separation, gas-solid separations, vapor-liquid separations, pumps, safety valves and rupture disks, steam ejectors, and vessel design. The design procedures are largely empirical and are supplemented with information on the thermal and transport properties of many materials and chemicals needed in the design of process equipment, the mechanical properties of a host of metals commonly used in their construction, and the dimensions and properties of piping and tubing.

The book's principle weakness results from the perceived assumption that the reader possesses a knowledge of the nature of the equipment discussed beyond that typical of the student or novice engineer. Illustrations are limited to an occasional schematic used primarily to relate dimensions to design relationships. This disadvantage is partially offset by the liberal use of example problems and by rules of thumb included to permit an approximate check of calculated results. Most of the design correlations are widely applicable and not limited to a unique device supplied by a single vendor.

In summary, the book will be useful to process design, pilot plant, and production engineers who wish to run a quick check of prior designs, to trouble shoot, and, in some cases, to use simplified procedures sufficiently accurate for a final design. It would be useful to have the book available in chemical engineering design classes, but it's coverage is probably too concise and applied for general use as a textbook.

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