Fluidization: Idealized and Bubbleless, with Applications

By M. Kwauk, Ellis Horwood, New York, 1992, 277 pp., $85.50.

While this book does give a reasonable review of the basic concepts of fluidization, it is primarily a summary of the research activities spanning the author's career. The first three chapters review the regimes of fluidization and different types of fluidization systems, contrast gas-solid and liquid-solid systems, in terms of their fluidization characteristics, and discuss various empirical relationships for the drag coefficient. Chapters 4 through 7 review the author's research in fluidized leaching and washing, solid segregation of polydisperse particle mixtures in fluidized beds, conical fluidized beds, and moving beds, respectively. Chapters 8 through 12 focus on his research in the area of bubbleless gas-solid contacting systems. These systems include dilute raining particles, fast fluidization, shallow fluidized beds, and particles fluidized under the influence of oscillating fluid flow. Chapter 13 details a multiscale energy minimization model developed by the author and Dr. J. Li. Chapter 14 discusses his work on powder characterization by fluidized-bed collapsing experiments and methods to improve fluidization characteristics by the addition of fines.

It should be noted that one-half of the pages in the text are figures or tables, and over two-thirds of these figures are taken directly from the publications of the author or his students. Unfortunately, some of the notations in the figures and tables are not explained in the text or in the nomenclature section. Therefore, the reader must refer to the original citations to understand clearly these figures and tables. Some of the references, however, are in obscure sources, written in Chinese or unpublished. About one-third of the references in the text represent post-1980 work, with one-third of these more recent references representing work of the author or his students.

The author uses a simplistic approach to predict the relationships existing among the operating variables of the various fluidization systems discussed and, in the author's own words he, "has not avoided presenting quantitative deliberations which have not been subject to rigorous experimental verification." To describe fluidization systems involving polydisperse particles, the author gives proposed corrections to the simplified relationships among the operating variables throughout the text. Notably absent in the text is any treatment of the general equations of change which are descriptive of fluid-particle motion at large.

For a more comprehensive treatment of fluidization, the author refers readers in the preface to two sections of the *Chinese Chemical Engineering Handbook*, which the author helped organize. It is somewhat surprising that the classic and widely adopted book in fluidization, *Fluidization Engineering*, by D. Kunii and O. Levenspiel, now in its second edition and recently reviewed by Professor L. S. Fan (*AIChE J.*, December 1992), is not mentioned or referenced anywhere in the text.

Overall, this text is a very good review of the author's significant contributions to the fluidization field. The text, however, cannot stand alone as a general book on fluidization.

Jennifer L. Sinclair
Chemical Engineering Dept.
Carnegie Mellon University
Pittsburgh, PA 15213

Porous Media: Geometry and Transport

By Pierre M. Adler, Butterworth-Heinemann, Stoneham, MA, 1992, 544 pp.

This book addresses the geometry of porous media in terms of phase functions and their integral transforms (Chapter 2), and then Stokes flow of liquid together with simple Fick's law diffusion of highly dilute solute in certain ideal, rigid pore structures. Those idealizations are spatially periodic structures (Chapter 4); so-named deterministic fractal networks and continuous fractals (Chapter 5); random networks and random continua (Chapter 6); and constructs called reconstructed porous media, (Chapter 7). There are over 500 pages of text. Altogether they might better have been titled "Mathematics of Discontinuously Heterogeneous Systems"

Serial sectioning and image analysis of porous media are mentioned, as are tomographic methods, Mapping of pore structure is not covered. Inertial effects in flow, deformation rate-sensitive viscosity, and Bingham yielding are touched on. Slip flow, fines movement, filtration, mechanical deformation, swelling, shrinking, adsorption and chemical reaction are among aspects of porous media geometry and transports *not* broached. Only single-fluid occupancy and flow are covered, so that fluid displacement transport processes such as imbibition and displacement are excluded. So too are phase change transport processes such as condensation and drying.

What are covered extensively are the mathematical formalisms of, and whole bodies of derived results about, spatially periodic dispersions and consolidated arrays, including networks of capillaries; convection with diffusion of a dilute component, including Taylor-Aris dispersion; fractal capillary networks, Apollonian (or Leibniz) packings, Menger sponges, and several related topics; and volume averaging. Site and bond percolation on networks, Kirchhoff's laws in graph-theoretic terms, finite size-scaling, renormalization and effective medium approximations are described. The chapter references are extensive and useful. They are particularly helpful in identifying unpublished as well as published work of Adler and his collaborators, and Brenner and his (Brenner was Adler's mentor more than a decade ago). Concrete applications of the formal derivations are frustratingly few in the text.