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# BOOK REVIEWS

R. A. MASHELKAR, A. S. MUJUMDAR and R. KAMAL (Editors), **Transport Phenomena in Polymeric Systems.** Ellis Horwood, Chichester, 1989. ISBN 0-7458-0663-5, 447 pp., £45.00.

THIS MULTI-author work forms what the editors call a 'special theme volume' of Advances in Transport Processes. It was originally published by Wiley Eastern in 1987. It comprises eight review articles on a wide variety of transport-related phenomena in polymeric systems.

Polymers are long chain molecules and it is the length and flexibility of the chains which give them their special physical properties. Chapter 1 by Marrucci discusses modelling of flows of polymers on a molecular level. The main discussion centres on the celebrated Doi–Edwards/de Gennes model, into which the author provides valuable new insights. Entanglements of polymer chains mean that liquid polymers are very viscous so flows of them are usually laminar. They are not always laminar, however. In solution, for example with water, flows can be turbulent and Chapter 5 by Giesekus and Hibberd discusses turbulence phenomena in drag reducing polymer solutions. At present, drag reduction is not fully understood. It seems likely that flow visualization will be an invaluable aid to obtaining such understanding. The authors include some interesting photographs but the quality of reproduction (like that of most of the figures in the book) is unfortunately so poor as to render them less useful than they might have been.

Entanglements of polymer chains also mean that the thermal conductivity and mass diffusivity of a polymer are very low. In Chapter 6, Dutta and Mashelkar discuss thermal conduction in liquids. They raise the interesting issue of the applicability of Fourier's law to materials with structures like polymers and thus bring into question the notion of thermal conductivity itself. Chapter 7 by Astarita on heat and mass transfer in solids, the briefest in the book, contains a discussion of certain complex phenomena associated with morphological changes. Chapter 8 by Lawal and Mujumdar on heat transfer in laminar duct flows is in many ways a generalization to the class of purely viscous non-Newtonian fluids of the comprehensive text by Shah and London comprising Supplement 1 to the series of *Advances in Heat Transfer*. The only significant topic not discussed here is flows in which there are large viscosity variations resulting from temperature variations in turn arising from heat generation by viscous dissipation or from an imposed temperature difference (that is high Nahme number or high Pearson number flows). Chapter 3 by Kemblowski, Dziubinski and Sek on flows through granular media generalizes many standard chemical engineering results to non-Newtonian fluids.

Chapter 2 by Mitschka, Wein and Wichterle is rather different from the rest. It is the longest article in the book. It uses a rather formal continuum mechanics approach to investigate rotational flows. The primary importance of these flows is in pumps and in meters for the measurement of the mechanical properties of polymers, in particular shear viscosity, extensional viscosity and normal stress differences. The authors give a rather complete account of the theory of such flows.

Overall, this collection of review articles is likely to be of great interest to those involved in polymer work. It is, however, of critical importance in reviews that the discussion be up to date. The latest references in Chapters 1, 3, 4, 5, 7 and 8 are dated 1983; the latest in Chapters 2 and 6 are dated 1985. In a field which is moving as rapidly as this one is, the reviews are inevitably less valuable than they might—and ought—to have been.

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J. R. HOWARD, **Fluidized Bed Technology—Principles and Applications.** Adam Hingler Edition, ISBN 0-85274-055-7.

THIS IS a well-written book on a subject which has attracted a great deal of interest over the last few decades. Although the number of research papers published on the topic of fluidization in general is vast, textbooks of this type remain very few and this is certainly a welcome addition.

The book is primarily intended for beginners and students who want to get an insight into the field of fluidized bed technology. Consequently each chapter is accompanied by worked examples which aid understanding and references for further reading. Particularly valuable is the treatment of fundamental processes involving interaction between particles and the suspending fluid. The treatment is sufficiently general to be applicable not only to fluidized beds but also other processes involving two-phase flow, such as the pneumatic transport of solids, or drying.

Six chapters and 200 pages cover the subject matter, with a good number of diagrammatic illustrations. After an Introduction, which serves as an overview and also defines the terms used in the book, Chapter 2 deals with the two-phase momentum exchange in a fluidized bed, particle classification, calculation of pressure drop and minimum fluidizing velocity, the theory of bubble formation, mixing and elutriation.

Chapter 3 deals with aspects of heat transfer. A quantitative description is given of the physics of two-phase heat transfer taking account of particle size, surface shape, and fluidizing velocity, on heat transfer between particles, bed and containing walls, or bed and heat transfer surfaces. Heat transfer coefficients are then derived mostly from empirical sources to cover all these cases and their use is illustrated in examples.

Chapter 4 provides some insight into the processes involved in the design of typical fluidized bed reactors. The text deals with estimates of bed size and fluidizing layouts, particle transport disengaging height, the design of distributors and ways of cooling and heat removal; single and multi-stage beds are considered. Finally, the factors affecting reactor size optimization are discussed.

Chapter 5 deals with possibly the earliest application of fluidized beds, in the combustion of solids. After a basic introduction into combustion systems the book touches on the subjects of emission control, combustion chamber sizing and the effects of pressurization. The combustion of single particles is then studied in some detail, followed by the effects of start-up. A brief description is also given of the Circulating Fluidized Bed.