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Mass Transfer in Heterogeneous Catalysis, C. N. Satterfield, Massachusetts Institute of Technology Press, Cambridge, Mass. (1970). 267 pages.

This book is a rather thorough and extensive revision of the author's previous effort, coauthored by T. K. Sherwood, entitled "The Role of Diffusion in Catalysis." Those engaged in research on the various aspects of chemical reaction engineering can certainly attest to the utility of that volume, and the present work promises to improve even on past performance. The primary emphasis is on the multitudinous effects that various types of mass transport rate limitations may have on the apparent activity, selectivity, poisoning, and general kinetic behavior of heterogeneous catalytic systems.

The first chapter of the book presents an extensive review of the mechanisms of mass transport in porous structures including a selective summary of some of the experimental results available in the literature. Also included here is a nice summary of some recent studies concerned with the surface diffusion of adsorbed gases in porous media. Second, comes a discussion of mass transfer to catalyst particles, that is, external boundary-layer resistances and their effects on catalyst performance. This chapter is divided into sections corresponding to reactor type, and while the information and correlations given for fixed and fluidized beds may be familiar to most in reaction engineering, the summaries on trickle beds and slurry reactors are most illuminating. In the following two chapters is given the treatment of intraparticle diffusion problems. First, the more simple cases, starting essentially with the classical problem of Dämkohler-Thiele-Zeldovitch, are discussed; the emphasis is predominately on simple reaction systems and the modification of activity and temperature sensitivity by diffusion. A thorough coverage of experimental studies validating the simple theory of catalytic effectiveness is given, and the problem of estimation of effectiveness factors from observable data is treated. The "complex cases" which are the points of interest in the following chapter include nonisothermal reaction systems, complex kinetics (that is, Langmuir-Hinshelwood rate forms and reversible reaction systems), and a few additional topics such as the effect of volume change on reaction. In the final chapter are

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A statistical model of a porous medium with nonuniform pores, Haring, R. E., and R. A. Greenkorn, **AIChE Journal, 16,** No. 3, p. 477 (May, 1970).

Key Words: A. Mathematical Model-8, Porous Medium-9, Nonuniform-0, Capillary Pressure-6, Mass Transfer-7, 8, Saturation-7, Dimension-6, Pores-9, Permeability-7, Porosity-7, Dispersion-7.

Abstract: A random network model of a porous medium with nonuniform pores has been constructed. Nonuniformity is achieved by assigning two-parameter distributions to pore radius and pore length. Statistical derivations result in expressions for bulk model properties which are consistent with known empirical behavior of porous media such as capillary pressure, hydraulic permeability, and longitudinal and transverse dispersion. A series of experiments is suggested whereby the parameters of porous media structure may be determined from observed macroscopic behavior by using the expressions developed in this paper.

Birefringent flow visualization of transitional flow phenomena in an isosceles triangular duct, Hanks, Richard W., and James C. Brooks, **AIChE Journal, 16,** No. 3, p. 483 (May, 1970).

Key Words: A. Flow-8, Water-9, Laminar-0, Turbulent-0, Transitional-0, Birefringent Fluid-10, Duct-9, Triangular-0, Dye-10.

Abstract: A flow visualization study was made by using an optically birefringent solution of milling yellow dye in water flowing through a transparent duct of isosceles triangular cross section. The present data confirm a number of theoretical predictions concerning transitional phenomena in triangular ducts. One of the most interesting of these phenomena is the existence of a region of simultaneous laminar and turbulent flow in the duct.

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treated a group of problems (which by location and association one is unfortunately tempted to classify as miscellany) on diffusionally influenced catalyst poisoning and regeneration, and on the very important situations in which reaction selectivity is debilitated by transport rate limitations.

I am a bit surprised at the title of this book. Since nonisothermal systems play such an important role in catalysis and reaction analysis, and they have indeed been treated in detail here, the scope of the presentation would be better indicated had the words ". . . and Heat . ." been inserted after "Mass." As indicated by the contents, the coverage of topics is broad, and the individual discussions are evenly balanced. There are a large number of example calculations given, which I feel are of great benefit in a book like this. There are, however, some points which would have profited from more development. The effects arising from a combination of internal and external gradients, particularly in nonisothermal systems, merit more attention, as does the selectivity problem. Yet, all in all, there isn't much in the general area of coupled transport and reaction rate problems in catalysis that cannot be gotten from this most useful reference work.

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