BOOKS

Thermal Conductivity of Gases and Liquids, N. V. Tsederberg, Massachusetts Institute of Technology Press, Cambridge (1965). 246 pages.

This book represents a monograph on the thermal conductivity of dilute gases and their mixtures, dense gases, liquids and their solutions, and aqueous electrolyte solutions. Also, methods are presented for the calculation of the thermal conductivity of plasmas. This text contains an excellent review of experimental and theoretical studies which, for the most part, were conducted in the Soviet Union. The author apparently does not mention other excellent contributions in this area which have been carried out elsewhere. Despite this shortcoming, this monograph represents an excellent compilation of the theoretical and experimental contributions of the Russian scientists that makes it a desirable reference text, especially since most of these references are not easily accessible elsewhere.

This text, translated by Scripta Technica, is sufficiently broad in its contents to make it a useful reference to engineers and scientists engaged in the design of processes encountered in the chemical industries and in research concerned with space technology and related fields.

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Chemical Reaction Analysis, Eugene E. Peterson, Prentice-Hall, Engelwood Cliffs, New Jersey (1963). 276 pages, $12.50.

This is an excellent book, and one that is very timely. Heretofore, it has been necessary to consult the journal literature for much of the information on the design and analysis of chemical reactors. Dr. Petersen has brought together the science and technology of chemical reactors and has presented it in a logical and understandable manner.

Much of the literature on chemical kinetics is characterized by hazy definitions and vague terminology. In contradistinction, here the terms are clearly defined and accurately used. Most of the definitions are presented first from a phenomenological point of view; and then the accurate mathematical relations are introduced.

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The material is presented very logically. The first chapter is a very brief but important introduction. The next two chapters are a treatment of the rate expressions for chemical reactions. The reaction rate of a homogeneous reaction is carefully defined so that it is the same for all species in the system. The expressions for a set of complex reactions are developed with matrix algebra. (An appendix provides an introduction to the matrix methods required.) Throughout the book no attempt is made to keep the mathematics at a low level, yet mathematics is not used simply for elegance. The kinetics of heterogeneous catalytic reactions are illustrated with a number of specific examples. This chapter also includes a section on the use of tracers in determining the mechanism of catalytic reactions.

The next three chapters, which comprise almost half the book, treat various aspects of the complex phenomena that occur in reactions involving porous catalyst particles. The many aspects of this important subject are treated in great detail. The physical properties of porous catalysts are described and defined, and methods for determining them are presented. An extensive treatment of the transport of energy and mass within a porous catalyst is presented in one chapter, while another chapter includes material on the transport between a fluid phase and the external surface of a reacting solid. A number of physical and mathematical models of these processes are presented. The author is careful to point out the important assumptions which are made and to justify them either because they are good ones or because no better ones can be made with the present state of knowledge. Many examples are presented to illustrate the methods described.

Two chapters are devoted to the design and analysis of fixed bed reactors utilizing the material developed in the earlier chapters. The author presents a number of simple and some complex models of these reactors and points out the consequences of using each type. Many phenomenological parameters, such as radial transport and axial dispersion, are discussed. The last chapter is a discussion of moving bed reactors which are inherently more difficult to analyze than are fixed bed reactors. The residence-time distribution, spatial-age distribution, and activity distribution are all discussed, and the relative merit of these three functions for various cases is presented.

I believe that this book will become an important source book for those working in the field of chemical reac-

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Analysis of heterogeneous catalytic reactions by nonlinear estimation, Lapidus, Leon, and T. I. Peterson, **A.I.Ch.E. Journal, 11,** No. 5, p. 891 (September, 1965).

Key Words: A. Analysis-8, Reactions-8, 9, Catalyst-10, Heterogeneous-0, Langmuir-Hinshelwood Models-10, Models-10, Dehydration-8, Ethanol-1, Nonlinear Estimation-10, Reaction Kinetics-8, 9, Determination-8, Parameters-9.

Abstract: Integral conversion catalytic data have been studied by nonlinear estimation to determine whether the Langmuir-Hinshelwood heterogeneous catalytic models are more valid than the simpler noncatalytic forms and whether it is possible to discriminate among models. The experimental system chosen for this study was the vapor phase dehydration of ethanol. The results suggest that only in the absence of obscuring effects is the complex catalytic model warranted.

Interaction model for critical temperatures of multicomponent mixtures of methane-free aliphatic hydrocarbons, Ekiner, Okan, and George Thodos, **A.I.Ch.E. Journal, 11,** No. 5, p. 897 (September, 1965).

Key Words: A. Critical Temperature-8, 9, Aliphatic Hydrocarbons-9, Hydrocarbons-9, Mixtures-9, Interaction Model-10, Multicomponent Systems-9, Calculation-8.

Abstract: A mathematical treatment based on an interaction model has yielded an expression capable of establishing the critical temperatures of multicomponent mixtures of aliphatic hydrocarbons. This model postulates an infinite-series expansion for the difference between the actual critical temperature and its corresponding pseudocritical value. For methane-free aliphatic hydrocarbon mixtures, this infinite series has been truncated beyond the third-order interactions. This interaction model has been applied to one hundred-sixteen different compositions of binary, ternary, quaternary, and quinary aliphatic hydrocarbon systems to produce an overall average deviation of 0.35%. Due to the different interaction behavior of methane, systems containing methane have not been included in this study.

Mathematical models for mass transfer accompanied by reversible chemical reaction, Huang, Chen-Jung, and Chiang-Hai Kuo, **A.I.Ch.E. Journal, 11,** No. 5, p. 901 (September, 1965).

Key Words: A. Mathematical Model-8, Mass Transfer-9, 8, 7, Chemical Reaction-8, 9, 6, Reversible-0, Rate-7, Liquid Phase-9, Interface-9, Diffusion-8, Diffusivity-9, Ratio-6.

Abstract: Based on the film-penetration theory, the film theory, and the surface renewal theory, theoretical equations are obtained for the rate of interphase mass transfer accompanied by a first-order reversible reaction. The equation based on the film-penetration theory can be reduced to those obtained on the basis of simpler postulations. An approximate rate equation is also proposed for mass transfer with a high order reversible reaction.

Falling cylinder viscometer for non-Newtonian fluids, Ashare, Edward, R. Byron Bird, and Jaime A. Lescarboura, **A.I.Ch.E. Journal, 11,** No. 5, p. 910 (September, 1965).

Key Words: A. Viscometer-8, 10, Viscosity-8, Non-Newtonian Fluids-9, 4, Annular Flow-4, Falling Cylinder Viscometer-8, 10, Rheology-8, Corrections-8, Curvature-9, Power-Law Fluid-9, Ellis Fluid-9, Ostwald-deWaele Fluid-9, Carboxymethylcellulose-9, Polymers-9.

Abstract: It is shown how previous analyses of the falling cylinder viscometer for Newtonian fluids can be extended to non-Newtonian fluids. Specific relations are given for the velocity of descent for several simple non-Newtonian viscosity functions. A differentiation procedure is presented whereby the non-Newtonian viscosity for a fluid can be deduced from velocity of fall measurements. In the course of the development, some useful approximate expressions for axial non-Newtonian flow in annuli are developed. Finally, a comparison of the Ellis and power law models is made by an analysis of the axial annular flow data of Fredrickson and of McEachern.

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tor design and analysis. The various tools of reactor analysis are described in enough detail that they can be used by the reader for his own problems, and the author has distinguished among the various techniques so that the reader can choose the ones which are most suitable for his problem.

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Thermodynamics, William C. Reynolds, McGraw-Hill, New York (1965). 458 pages, $9.50.

Another textbook of thermodynamics added to the long list of those already in existence. One can't help wondering whether another is justified. After reading this one I concluded that it was not just another ordinary text, but a text with many new ways of presenting old ideas and concepts. One may not always feel that the new ways are any improvement over the older, but at least the different approach is refreshing.

The first four chapters present and develop the basic concepts in a sensible and easily followed manner without getting lost in a maze of semantics which seems to characterize some of the modern texts. In an attempt to define concepts and to state the laws very precisely some books only succeed in making me completely confused about things which previously I had thought I understood, at least well enough to apply the principles to the solution of problems. Although this book presents many of the basic ideas in a way that is different from the treatment in what one might call the "standard" texts, yet I found it clear and easy to follow.

Chapter 5 illustrates the first law by making energy balances on a wide variety of systems. In making these analyses the author lays great stress on what he calls the "control volume" and the "control mass." As near as I can determine this just amounts to giving new names to the methods most of us have used for a long time. Perhaps this may result in some clarification for the student; I am not sure. I do applaud the many numerical examples worked out and the clear statement of the assumptions in each case.

In Chapter 6 entropy and the second law are introduced entirely through the methods of statistical mechanics rather than the classical methods of Carnot, Clausius, Kelvin, and Planck. This is not the method by which the