BOOKS

Transport Phenomena in Fluids, Howard J. M. Hanley, ed., Marcel Dekker (1969). 509 pages + xii. $25.50.

This multiuathored book deals with the transport phenomena in gases and liquids: chapters 1 to 5 emphasizing the macroscopic approach, chapters 6 to 8 the molecular approach, and chapters 9 to 12 the experiments. The developments of the past two decades are emphasized, so that much of the material in the book is not covered in "Molecular Theory of Gases and Liquids" which appeared in 1954. The authors seem to have achieved a unanimity of purpose and an agreement on level of presentation better than one encounters in most multiauthored books. It is unfortunate, however, that they did not agree on the notation to be used for commonly used symbols or at least provide the reader with a symbol list. One finds, for example, that x_k is a mass fraction in chapters 2, 3, and 8 but mole fraction in chapters 7 to 10; similar confusion is encountered in the definitions of the energy and momentum fluxes

The first four chapters (by the editor) attempt to provide an introduction to fluid dynamics and nonequilibrium thermodynamics; this material is taken, with appropriate acknowledgment, largely from the monograph of de Groot and Mazur. In these chapters the equations of change and flux expressions are summarized; no mention is made of angular momentum or of non-Newtonian or viscoelastic properties. Chapter 5 (by George H. Weiss) concludes the first part of the book with the fluctuation theory approach to irreversible phenomena; this includes the discussion of a number of doubly baptized equations and theorems bearing the illustrious names of Chapman-Kolmogoroff, Fokker-Planck, Wiener-Khintchine, and Green-Kubo. The material is not applied directly to mass, momentum, and energy transport, however.

The second part of the book begins with chapter 6 on the kinetic theory of dilute gases (by E. G. D. Cohen); this includes an elementary derivation of the Boltzmann equation, a discussion of the eta theorem, the development

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Fixed bed adsorption drying, Chi, C. W., and D. T. Wasan, **AIChE Journal, 16,** No. 1, p. 23 (January, 1970).

Key Words: Adsorption-4, 8, Desorption-4, 8, Drying-4, 8, Fixed Bed-9, Supported Bed-9, Hygroscopic Salts-10, Torvex-5, 10, Adiabatic-5, 10, Humidity-4, 6, Temperature-6, Velocity-6, Adsorption Rate-7, Desorption Rate-7, Adsorbate-1, 3, Adsorbent-1, 5, Dry Air-2, Water-Vapor-1.

Abstract: In this paper, mathematical models for a single adsorbate component present in a gas phase have been developed for isothermal and adiabatic dynamic adsorption-desorption processes with special emphasis on adsorption drying by supported hygroscopic salts. The proposed generalized models are applicable to both an unsupported adsorbent bed and a fixed bed of adsorbents impregnated on a supporter which may have nonlinear equilibrium relationships. The partial differential equations governing the dynamic adsorption-desorption processes and the nonlinear equilibrium relations were solved numerically on the digital computer.

An experimental study was conducted to measure the adsorption and desorption rates of water vapor by lithium chloride impregnated on a solid supporter, Torvex.

The proposed adiabatic adsorption-desorption model has been verified for unsupported adsorbent beds in the cases of water-vapor adsorption from air by silica gel and of methane adsorption from a helium-methane mixture by activated carbon. The validity of the generalized adiabatic model for supported adsorbent beds with nonlinear equilibrium relationships was established by a direct comparison of experimental data obtained in this study with the predicted values.

Gaseous diffusion in the transition pressure range, Mistler, T. E., G. R. Correll, and J. O. Mingle, **AIChE Journal, 16,** No. 1, p. 32 (January, 1970).

Key Words: A. Diffusion-7, 8, Self-Diffusion-7, 8, Carbon Dioxide-9, Methane-9, Gases-9, Transition-9, Pressure-6, Additive Resistance Law-10.

Abstract: Measurements of the effective self-diffusion coefficients for carbon dioxide and methane were performed in the transition pressure range. The results verify that the additive resistance law is valid for the representation in the transition range. The unknown effects of surface diffusion make the values to be employed in this law subject to review. As an example, one surface diffusion model is considered.

Temperature gradients in turbulent gas streams; investigation of the limiting value of total Prandtl numbers, Chia, Wu-Sun, and B. H. Sage, **AIChE Journal, 16,** No. 1, p. 37 (January, 1970).

Key Words: A. Viscosity-7, 8, Heat Transfer-7, 8, Conductivity-7, 8, Eddy-0, Position-6, Reynolds Number-6, Flow-6, Air-9, Plants-9, Prandtl Number-7, 8.

Abstract: Measurements of the total viscosity and total conductivity were made as a function of position and Reynolds number for the flow of air between two parallel plates. The investigations were carried out at Reynolds numbers from 40,000 to 100,000. The results obtained indicate little change in the total Prandtl number with increasing Reynolds number from the value of the molecular Prandtl number.

The measurement of surface temperatures with platinum films during nucleate boiling of water, Foltz, G. E., and R. B. Mesler, **AIChE Journal, 16,** No. 1, p. 44 (January, 1970).

Key Words: Bubbles-8, 9, Nucleate Boiling-4, Microlayer-8, High-Speed-0, Water-9, Heat Transfer-4, Photography-10, Surface Thermometer-8, 9, Fast Response-0, Platinum Film-8, 9.

Abstract: This report describes a simple and reliable method of constructing small platinum film thermometers on Pyrex glass. The thermometers were used to measure surface temperature during nucleate boiling of water at pressures between 1 and 4 lb./sq.in.abs. The thermometers showed that as superheated microlayers of water evaporated beneath vapor bubbles, the surface temperature often dropped 40° to 75°F. before ultimately reaching the saturation temperature. The thermometers proved to be accurate (±1°F.) and capable of fast response (145°F./msec.).

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of formal expressions for the transport properties of a pure monatomic gas, and the connection with irreversible thermodynamics. The details of the Chapman-Enskog expansion are not dealt with, nor are polyatomic gases; quantum effects are given only a short discussion. The so-called *Krooked* Boltzmann equation is not discussed. Chapter 7, by the same author, deals with moderately dense monatomic gases and presents only the Bogoliubov-Uhlenbeck-Cohen viewpoint developed largely since the late 1950's; other viewpoints are not discussed or even referred to. Chapter 8 (by W. A. Steele) is devoted to the time-correlation function approach to transport phenomena; this long (over 100 pages) discussion summarizes the developments in the field since the basic papers of Kubo (1957) and Callen (1951 to 1952). Considerable space is devoted to spectral absorption and scattering of radiation.

The third part of the book starts out with chapter 9 (by H. J. M. Hanley), which summarizes the calculations based on the Chapman-Enskog dilute gas theory for the Lennard-Jones (m, n), Kihara, Exp-6, and Morse potential functions. Extensive comparisons for the noble gases nitrogen and oxygen are given. Polar gases, associating gases, and quantum effects are not discussed. Chapter 10 (by K. E. Grew) is devoted to the kinetic theory, experimental techniques, and experimental data on thermal diffusion; a short section is included on multicomponent mixtures (which receive little or no attention elsewhere). Chapter 11 (by D. G. Miller) is a corrected reproduction of a paper, *Chem. Revs.*, **60**, 15 (1960), and deals with the experimental verification of the Onsager relations; this includes thermoelectricity, electrokinetics, electrolytic transference, three-component diffusion, thermal conduction in anisotropic solids, and galvanomagnetic and thermomagnetic effects. In the final chapter (by D. C. Mikulecky) is a 60 page discussion of biological problems; the primary focus is on membrane transport in multicomponent reacting systems.

This book will be appreciated by teachers of advanced (graduate level) transport phenomena courses and to researchers in fluid properties, since it is an up-to-date status report of an active field and includes an extensive bibliography.

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