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Experimental vapor-liquid equilibrium data for propane-isobutane, Hipkin, Howard, **A.I.Ch.E. Journal, 12,** No. 3, p. 484 (May, 1966).

Key Words: A. Equilibria-8, 7, Phase Equilibria-8, 7, Propane-9, Isobutane-9, Mixtures-9, Alkanes-9, Liquid-9, Vapor-9, Isothermal-0, Binary-0, Appa-atus-8, 10, Measuring-4, 8, Pressure-9, 6, Temperature-9, 6, Composition-9, 6, Relative Volatility-7, 2, Calculating-8, Activity Coefficients-2, Fugacity Coefficients-2.

Abstract: Isothermal vapor-liquid equilibrium data for propane-isobutane solutions at five temperatures (from 20° to 250°F.) are presented. The experimental data are tabulated and plotted as pressure vs. composition and relative volatility vs. liquid composition for each temperature. Activity coefficients and fugacity ratios a e calculated for the four lower temperatures. The two different pieces of apparatus used in this study are described in detail. Sampling errors which occur in volatile systems are also discussed.

An equation of state for gas mixtures, Othmer, Donald F., and Hung Tsung Chen, **A.I.Ch.E. Journal, 12,** No. 3, p. 488 (May, 1966).

Key Words: A. Deriving-8, Equation of State-2, 10, Mixtures-4, 9, Gases-4, 9, Calculating-4, 8, Predicting-4, 8, Temperatures-1, 2, 9, Pressures-1, 2, 9, Volume-1, 2, 9, Compressibility Factors-1, 10, Computer-10. B. Deriving-8, Calculating-8, Equation of State-2, Compressibility Factors-2, Force Constants-1, 2, Pressures-1, Temperatures-1, Reduced-0, Pseudocritical Constants-1, 10, Reference Substance Technique-10.

Abstract: A theoretical model is developed in which a mixture of gasses is assumed to have the same thermodynamic properties as some pseudo gas which would have the same force constants existing between each pair of molecules in the mixture. Force constants of the gas mixtures are evaluated from pseudocritical constants which are evaluated from the critical constants of the individual components of the gas mixtures. With the use of the reference substance technique the compressibility factors for gas mixtures are calculated. The equation of state for gas mixtures developed in this paper utilizes these compressibility factors to determine pressure-volume-temperature relations. PVT data calculated using this equation are compared with experimentally determined PVT data.

Ion exchange equilibria under pressure, Hamann, S. D., and I. W. McCay, **A.I.Ch.E. Journal, 12,** No. 3, p. 495 (May, 1966).

Key Words: A. Pressure-6, Hydration-6, Concentration-7, Equilibria-7, Equilibrium Product-7, 2, Volume Change-7, 2, Absorption-7, 9, 8, Sodium Chloride-9, 1, Sodium Ions-9, 1, Chloride Ions-9, 1, Ion Exchange Resins-9, 10, Ion Exchange-9, De-Acidite M Resin-9, 10, Zeo-Karb 226 Resin-9, 10, Calculating-8.

Abstract: A study of the effects of high pressures on ion exchange equilibria is reported. Experimental data on the uptake of sodium chloride from aqueous solutions under high pressure by a mixed bed resin are also presented. Volume changes in the absorption process are studied and compared to volume changes that occur in proton transfer from a free carboxylic acid to an amine in solution.

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graphs, tables, and equations are excellent representations of published data. For example, data for the boiling crisis for water flowing along bundles of heated rods are tabulated from sixteen sources. For each source the test conditions are summarized carefully.

Unfortunately the book is often uncritical. The original opinions of the various references are presented. For example, on page 117, data are given which show that flow velocity has no effect on the heat flux during nucleate flow boiling, but on page 122 data from a different source are presented which show that velocity does have an effect. The puzzled reader is left to decide for himself. The opinions of Dr. Tong as to which data and equations on boiling and two-phase flow look good to him and which seem doubtful would have been welcome in this book.

The book contains seven chapters. The first two cover pool boiling and bubble dynamics. Taylor and Helmholz instabilities are discussed briefly. The next two chapters consider two-phase flow of water and air or steam, primarily in unheated channels. The last three chapters cover two-phase flow with boiling. The design equations used by Westinghouse, General Electric, and other builders of boiling-water-cooled nuclear reactors are given. It is clear that knowledge of boiling and two-phase flow has increased enormously in recent years but that many of the useful equations represent engineering art rather than physical analysis. Unfortunately, the term *theoretical* is applied to certain empirical correlations. This will mislead many readers.

In summary, the chief value of the book is that it is a compendium of data and references. Its principal weakness is that the relative reliability of data and equations from different sources is not pointed out. Persons working in the field of two-phase flow with boiling will feel that the volume is worth the purchase price.

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Industrial Heat Transfer, Alfred Schack (translated by I. Gutman), John Wiley and Sons, New York (1965). 456 pp.

Those engineers familiar with earlier editions of Professor Schack's treatise will find that the sixth edition has been improved considerably, not only in portions of the text, but also in the tables of the Appendix. Those unfamiliar with it will find the title misleading and the treatment of many topics too brief;

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A mathematical treatment of the effect of particle size distribution on mass transfer in dispersions, Gal-Or, Benjamin, and H. E. Hoelscher, **A.I.Ch.E. Journal, 12,** No. 3, p. 499 (May, 1966).

Key Words: A. Mass Transfer-8, 9, Diffusion-10, 9, 8, Dispersions-9, Dispersed Systems-9, Bubbles-9, Drops-9, Mixing-6, Size-6, Size Distribution-6, Reaction-6, Interaction-6, Rate-7, 2, Coefficient-7, 2, Calculating-8, 4, Mathematical Model-10, 8.

Abstract: A mathematical model is proposed that considers the interaction between drops or bubbles in a swarm as well as the effect of particle size distribution. The model is used to solve the equations for unsteady state mass transfer with and without chemical reaction when the drops are suspended in an agitated fluid. Steady state diffusion to a family of moving drops with clean interface and without interaction and chemical reaction has also been analyzed. The equations presented permit the estimation of diffusion rate per unit area of interface as well as the average concentration and the total average rate of mass transfer in the disperser under pseudo steady state conditions.

Longitudinal dispersion in rotating impeller types of contactors, Miyauchi, Terukatsu, Hiromi Mitsutake, and Ichiro Harase, **A.I.Ch.E. Journal, 12,** No. 3, p. 508 (May, 1966).

Key Words: A. Measuring-8, Rates-9, 2, Interstage Mixing-9, 8, 4, Dispersion Coefficient-9, 2, Longitudinal Dispersion-9, 2, Mixco Columns-9, 10, Rotating Disk Contactors-9, 10, Columns-9, 10, Mixing-9, 8, 4, Correlating-8 Equations-9, 2, Calculating-4, 8, Predicting-4, 8.

Abstract: On the basis of a back-flow model, the rates of interstage mixing of continuous phase for rotating disk contactor and Mixco columns are measured experimentally under flow and nonflow conditions. These rates are correlated into dimensionless formulas for wide combinations of operational condition, column geometry, and column dimensions. The formulas are put into a single formula by introducing the power number as an additional parameter. The final correlation covers the impeller Reynolds number from 3.5×10^3 to 1.0×10^6 and the diameter of columns from 4.1 to 218 cm.

Computational studies of transients in packed tubular chemical reactors, Crider, J. E., and A. S. Foss, **A.I.Ch.E. Journal, 12,** No. 3, p. 514 (May, 1966).

Key Words: A. Calculating-8, 4, Temperatures-2, 9, Concentrations-2, 9, Gradients-2, 6, 7, Temperature Transients-2, 6, 7, Concentration Transients-2, 6, 7, Tubular Reactor-9, Packed Reactor-9, Packing-9, Reactants-9, Fluids-9, Reaction-9, Rate-7, Dynamics-7, Mathematical Models-10, 8, Finite-Stage Model-10, Plug Flow Model-10, Two-Dimensional Model-10, One-Dimensional Model-10, Computer Program-10, Thermal Capacity-6, Heat Resistance-6, Radial Mixing-6, Axial Mixing-6.

Abstract: Concentration and temperature transients in a packed-bed tubular chemical reactor were calculated from mathematical models in order to determine the effects of several phenomena on the reactor dynamics. These phenomena included the thermal capacity of the packing, the resistance to heat flow between the packing and the fluid, the coupling of temperature and concentration through the rate of chemical reaction, axial fluid mixing, radial fluid mixing, and loss of heat at the wall. Three mathematical models were used: a two-dimensional finite-stage model, a one-dimensional finite-stage model, and a one-dimensional first-order differential model.

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this book would be more appropriately entitled "The Heat Transfer of Industrial Furnaces." It is an exposition of the basic heat transfer technology required by the engineer practicing in the design and evaluation of performance of industrial furnaces.

The mathematical treatment of most topics corresponds to that of an undergraduate textbook, while much of the practical information is provided in the form of recommendations for proper application, in the style of a handbook. Furthermore, this book is unsuitable as a reference text in heat transfer, such as McAdams' *Heat Transmission,* due both to its limited bibliography and to the fact that the bulk of the reference material is German in origin and is drawn almost exclusively from the 1910 to 1935 period. The shortcomings of this book include the total omission of discussion of the work of T. von Karman, R. C. Martinelli, E. Hofmann, and E. N. Sieder and G. E. Tate among others; the summary handling of condensation and liquid metals heat transfer; and the complete neglect of boiling heat transfer and two-phase flow phenomena—after all, a boiler is an industrial furnace.

The translation of the descriptive material is first-rate with only an occasional slip due to contrasting idiomatic usage; for example, on page 234, first paragraph, "five times as much" should be "one-fifth as much" and "little more than half as much" should be "little less than twice as much." But the conversion of all equations to English units creates awkward looking formulas as well as some errors. For example, dynamic viscosity is used (that is, the ratio of viscosity to the gravitational acceleration) with "seconds" as the unit of time, while velocity is defined as "feet per hour"; thus, the Reynolds number (see page 84) to be accurate must be "corrected" by dividing the given expression by 3,600 sec./hr. Other errors have also crept into this edition; for example, page 175, "coefficient between wall and pipe" should be "water and pipe" and on page 181, Eq. 372, the symbol for the Reynolds number has been omitted, while on page 190, Eq. 376, the exponent has been omitted from the viscosity ratio.

Thus, it is imperative that the user of this book not accept statements on face value, but must satisfy himself (via careful study) of accuracy and validity. For this reason, the book cannot be recommended for use as a text in an undergraduate course of study. It may prove useful to the furnace design engineer as a reference.

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