BOOKS

Applied Thermodynamics, American Chemical Society Publications, Washington, D.C. (1968). 350 pages. $11.00.

This is a collection of papers reprinted from *Industrial and Engineering Chemistry*, September 1967 to July 1968. Most of these papers were presented at the Fourth Summer State of the Art Symposium held in Washington in June 1967 but a few other appropriate ones were added. They present a comprehensive review of many of the aspects of thermodynamics that are of great value to chemists and chemical engineers who are concerned with its application to their problems. The names of the authors, most of whom are well-known in the field bear witness to the authoritative nature of the treatment.

Strictly speaking, reviewing a volume of this character is neither feasible nor useful. Perhaps the best service the reviewer can offer to prospective customers is to list the titles of all the papers so that a reader can decide whether or not he wishes to own the book. If he makes any use of thermodynamics in his work, and I suspect this includes a fair proportion of all chemists and chemical engineers, he will find it hard to resist. Of course, he can find the same material in Industrial and Engineering Chemistry but scattered through eleven different issues and it is a considerable convenience to have them all assembled under one roof.

The list of titles follows:

"Molecular Theories of Liquids and Mixtures," J. S. Rowlinson.

"Molecular Thermodynamics of Chemical Reactions," C. A. Eckert.

"Irreversible Thermodynamics in Engineering," James Wei.

"Applications of Statistical Mechanics: Equilibrium Configurational Properties of Fluids and Fluid Mixtures," J. P. O'Connell and J. M. Prausnitz.

"Equations of State." J. J. Martin.

"Corresponding States Principle: A Review of Current Theory and Practice," T. W. Leland and P. S. Chappelear.

"Correlating and Predicting Thermodynamic Data—Reference Substance Equations and Plots," D. F. Othmer and H. T. Chen.

"Enthalpies of Fluids at Elevated Pressures and Low Temperatures," V. F. Yesavage, D. L. Katz, J. E. Powers, and A. E. Mather.

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The change in pore size distribution from surface reactions in porous media, Schechter, R. S., and J. L. Gidley, **AIChE Journal, 15,** No. 3, p. 339 (May, 1969).

Key Words: Reaction-6, Acid-6, Distribution-7, 8, Size-9, Pores-9, Mathematical Model-10, Hydrochloric Acid-1, Limestone-5, Porous Media-5, Liquid-6.

Abstract: When a porous solid is penetrated by a reactive fluid which changes the pore geometry, the macroscopic properties of that porous material may be greatly changed. A model is proposed in which the matrix is visualized as being a number of short cylindrical pores dispersed randomly throughout the solid. The change in the distribution of these cylindrical pores is then represented by an integro-differential equation which is solved for two special cases. The case considered here is that of a surface reaction which dissolves the solid thus continuously enlarging the pores. The rate of reaction is calculated theoretically using a laminar flow diffusion model and this growth rate expression is then taken as the basis for numerical calculations relating to the action of dilute hydrochloric acid on limestone.

Mathematical analysis of bubble dissolution, Duda, J. L., and J. S. Vrentas, **AIChE Journal, 15,** No. 3, p. 351 (May, 1969).

Key Words: Dissolution-8, Growth-8, Bubbles-9, Perturbation Series-10, Mathematical Model-10, Isothermal-0, Finite Difference Method-10, Determination-4, Diffusivity-9.

Abstract: A perturbation series solution is derived for isothermal bubble dissolution and bubble growth from an initially finite size. The accuracy and range of validity of the new results are investigated by comparison with finite-difference solutions of the equations governing bubble growth or dissolution. In addition, previous numerical solutions of the problem are compared to the finite-difference results of this study.

Heat transfer from a cylinder in an air-water spray flow stream, Mednick, R. Lawrence, and C. Phillip Colver, **AIChE Journal, 15,** No. 3, p. 357 (May, 1969).

Key Words: A. Heat Transfer Coefficients-8, Local-0, Cylinder-9, Temperature-6, Stainless Steel-9, Air-Water-9, Reynolds Number-6, Flow-6, Heat Transfer-8, Heat Flux-4, Velocity-6, Nusselt Number-6, Temperature Distribution-7, Resistance Heating-10, Experimental-0, Two-Phase-9, Two Component-9, Water Spray-9.

Abstract: Forced convection heat transfer from vertical cylinders normal to an air-water spray flow stream was measured over an air velocity range from 60 to 140 ft./sec. and a water spray density range from 0.03 to 0.50 $lb._m$/(min.)(sq. in.) Local heat transfer coefficients were determined at 15 deg. intervals around the circumference of both a 1.5 and a 1.0 in. diameter cylinder. It was found that the addition of 0.426 $lb._m$/(min.)(sq. in.) of water spray to a 133 ft./sec. air stream raised the stagnation point heat transfer coefficient from 45 to 1,650 B.t.u./(hr.)(sq.ft.)(°F.). Similar intensification was found for other angles around the cylinder circumference; however, the magnitude decreased with increasing distance from the stagnation point. Local heat transfer coefficients were normalized with respect to their corresponding stagnation point values and plotted parametrically as a function of angle and air velocity. These profiles showed that the normalized heat transfer coefficients decreased with increasing air velocity at angles other than the stagnation point. Average cylinder heat transfer coefficients were calculated from air-water data and two correlations were obtained relating these coefficients to the air and the water spray Reynolds number.

A thermodynamic equation relating equilibrium vapor-liquid compositions and enthalpy differences in isobaric multicomponent systems, Tao, Luh C., **AIChE Journal, 15,** No. 3, p. 362 (May, 1969).

Key Words: A. Equation-8, Thermodynamics-8, Vapor-Liquid Equilibria-8, Isobaric-0, Compositions-8, Enthalpy-4, 8, Binary-0, Multicomponent-0, Calculation-4, Ethanol-9, Water-9, Testing-4, Data-4, Toluene-9, *N*-Heptane-9, Cyclohexane-9.

Abstract: A rigorous and simple thermodynamic equation relating equilibrium vapor-liquid compositions and the phase enthalpy differences for a binary, isobaric system is extended to multicomponent systems. An analysis is made to indicate the potential applications of computing the latent heat of vaporization directly from the isobaric vapor-liquid equilibrium data and testing the consistency of phase composition and enthalpy data.

Free tear sheets of the information retrieval entries in this issue may be obtained by writing to the New York Office.

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"PVT Measurements on Petroleum Reservoir Fluids and Their Uses," R. H. Jacoby and L. Yarborough.

"Thermodynamic Excess Properties of Binary Liquid Mixtures—The Role of Empiricism," H. C. Van Ness.

"Group Contributions in Mixtures," C. H. Deal and E. L. Derr.

"Calculation of High-Pressure Vapor-Liquid Equilibria," P. L. Chueh and J. M. Prausnitz.

"The Adsorption of Gas-Mixtures—A Thermodynamic Approach," A. L. Myers.

"Physico-Chemical Measurements by Gas Chromatography," R. Kobayashi, H. A. Deans, and P. S. Chappelear.

"Thermodynamic Aspects of Capillarity," J. C. Melrose.

"The Thermodynamic Properties of Transition-Metal Alloys," J. B. Darby.

"Thermodynamic Properties of Cryogenic Fluids: Survey of Data," G. M. Wilson, R. G. Clark, and F. Hyman.

"Calculation of Complex Chemical Equilibria," F. J. Zeleznik and S. Gordon.

"A General Purpose Physical Data System for Computer Process Calculations," L. C. Yen, K. R. Cantwell, and B. L. Giles.

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Cost Effectiveness—The Economic Evaluation of Engineered Systems, J. Morley English, Editor, John Wiley, New York (1968). 301 pages.

The editor has performed a worthwhile service by bringing into book form the lectures of a short course which he organized at U.C.L.A. The systems approach to engineering decisions received much of its original impetus from applications to weapon system operation and procurement. More recently attention has broadened to such subjects as the space program, transportation systems, waste disposal, and information handling.

In systems engineering attempts are made to measure the effectiveness of systems in terms of their costs. There is much in common with conventional engineering economics or design. The most significant difference implied in the title cost-effectiveness is in the methodology proposed for considering multiple values. This essentially involves a rating system whereby different kinds of values can be brought to a common scale. Thus for a large system, such as a river basin development, one component of the product,

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