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Effects of interfacial instability on film boiling of saturated liquid helium I above a horizontal surface, Frederking, T. H. K., Y. C. Wu, and B. W. Clement, **A.I.Ch.E. Journal, 12,** No. 2, p. 238 (March, 1966).

Key Words: A. Models-8,9, Thermohydrodynamics-8, Theoretical-0, Thermohydrodynamic Models-8,9, Heat Transfer-8,7, Film Boiling-10,8,7, Helium I-1,9, Cryogenic Liquids-1,9, Surfaces-9, Horizontal-0, Gravity-6, Interfacial Instability-6,7, Viscosity-6, Temperature Differences-6, Heat Transfer Coefficients-7,9, Correlating-8.

Abstract: Film boiling above a horizontal surface has been investigated theoretically and experimentally at standard gravity and 1 atm. Theoretical film boiling results for conventional fluids have been extended, on the basis of interfacial instability due to gravity, to include liquefied gas properties, such as low viscosity and small surface tension. Heat transfer data taken at surface excess temperatures ΔT (above the boiling point) between 80° and 300°K. have been correlated with a theoretical model.

Why thermodynamics is a logical consequence of information theory, Tribus, Myron, Paul T. Shannon, and Robert B. Evans, **A.I.Ch.E. Journal, 12,** No. 2, p. 244 (March, 1966).

Key Words: Developing-8, Deriving-8, Physical Properties-7,9, Properties (Characteristics)-7,9, Mechanics-9, Thermodynamics-7,9, Entropy-9,10, Newtonian-0, Information Theory-6, Equilibrium-6.

Abstract: The purpose here has been to show how the basic ideas of classical thermodynamics arise quite naturally out of the information theory approach.

Surface motion and gas absorption, Muenz, Kurt, and J. M. Marchello, **A.I.Ch.E. Journal, 12,** No. 2, p. 249 (March, 1966).

Key Words: A. Mass Transfer-8, 9, Interfacial-0, Absorption-10, 8, 9, Gases-1, Oxygen-1, Helium-1, Carbon Dioxide-1, Propylene-1, Water-5, Rate-8, 7, 2, Effective Diffusivity-2, 10, 7, Molecular Diffusivity-2, Diffusivity-2, 7, Waves-6, 9, Marangoni Instability-6, Frequency-6, Surface Tension-6, Calculating-8, Correlating-8, Grashof Number-2, 6, Experimental-0, Theoretical-0, Data-9.

Abstract: The influence of small waves on mass transfer from pure gases into water is investigated. Small-amplitude progressive two-dimensional waves are mechanically generated at the liquid surface for the wave studies. Control experiments with nonwaved surfaces are also conducted. The effect of surface motion arising from Marangoni instability is considered for nonwaved surface. An effective diffusivity is used to correlate the data.

Bubble motion and mass transfer in non-Newtonian fluids, Barnett, Stanley M., Arthur E. Humphrey, and Mitchell Litt, **A.I.Ch.E. Journal, 12,** No. 2, p. 253 (March, 1966).

Key Words: A. Mass Transfer-8,9, Absorption-8, Bubbles-1,9, Carbon Dioxide-1, Sodium Carboxymethylcellulose-9, Carboxymethylcellulose-9, Fluids-9, Non- Newtonian-0, Ellis Model Fluid-9, Rheology-8, Drag Coefficients-8, Age-6, Diameters-6, Shapes-6,7, Motion-6, Instantaneous-0, Mass Transfer Coefficients-7,8. B. Correlating-8, Drag Coefficients-9, Reynolds Number-9, Ellis Model Fluid-9, Non-Newtonian-0, Bubbles-9, Fluids-9.

Abstract: Instantaneous mass transfer coefficients were obtained for the absorption of carbon dioxide bubbles rising in an aqueous solution of sodium carboxymethylcellulose. The rheological character of the non-Newtonian solutions was described by the Ellis model. The effects of bubble age, bubble diameter, and bubble shape transitions on mass transfer coefficients were studied. Drag coefficient data were correlated with a new Reynolds number which was derived from both the Newtonian and power law-like terms of the Ellis model.

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The significant contributions provided are, first, the organization and merging of many techniques that have been receiving increasing attention in recent years and, second, a demonstration of the use of these techniques in the language and idiom of chemical engineering. This is sufficient alone to insure the use and success of the book.

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Heat Exchanger Design, Arthur P. Fraas and M. Necati Ozisik, John Wiley & Sons, Inc., New York (1965). 386 pages, $17.50.

Heat Exchanger Design may augur for the ever-hopeful an encyclopedic, information retrieval work. This was not the authors' objective. Rather, they sought to fill the void created by "the rapid evolution of technology since World War II, particularly in the aerospace and nuclear fields"—which is not necessarily the chemical engineer's domain.

Aerospace is disposed of in eight pages with illustrations to spare. What remains are reflections on elementary heat transfer from the vantage of one national nuclear laboratory. The treatment is from the buyer's point of view rather than the seller's, the latter being much more demanding.

The two hundred and seventy pages of 8½ in. × 11 in. text are divided into sixteen chapters covering an ambitious array of subjects. Chapter titles new to heat transfer primers include "Heat Exchanger Types and Construction," "Heat Exchanger Fabrication," "Stress Analysis," "Heat Exchangers for Liquid Metals and Molten Salts," "Cooling Towers," and "Heat Exchanger Tests." From an organizational standpoint the book's major shortcoming lies in the authors' compulsion for scope. If their objective was a concise elementary survey of heat transfer it became necessary to treat each of the sixteen chapters with less than admissible superficiality.

Under scrutiny, the sources of much of the material do not fare very well. Many of the references were gleaned from the recent literature where experimental results were correlated as *mean* values. It is well known in industry that the use of such procedures in commercial design is hazardous. First, by definition half the values one might compute from such correlations must be unsafe. Second, the deficiency must usually be compounded with similitude

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Rates of hydrogen chloride oxidation, Jones, Alva M., Harding Bliss, and Charles A. Walker, **A.I.Ch.E. Journal, 12,** No. 2, p. 260 (March, 1966).

Key Words: A. Rate-8,9,2, Rate Equation-8,2, Oxidation-8,9,4, Recation-8,9, Hydrogen Chloride-1, Oxygen-1, Chlorine-2, Catalysts-10, Chromic Oxide-10, Girdler T-564-10, Girdler G-41-10, Measuring-8, Calculating-8, Activation Energy-2, Kinetics-8, Recycling Reactor-10. B. Temperature-6, Concentration-6, Nitrogen-9,6, Oxygen-9, Hydrogen Chloride-9,1, Water-9, Chlorine-9,2, Rate-7, Oxidation-9. C. Volatility-8, Stability-8, Catalysts-9, Chromic Oxide-9, Girdler G-41-9, Girdler T-564-9, Oxidation-4, Hydrogen Chloride-1, Chlorine-2.

Abstract: An experimental study of the chemical oxidation of hydrogen chloride to chlorine is reported. The measurement and correlation of reaction rates with temperature and concentration data are the primary purposes of this study. The stabilities and volatilities of the catalysts used are also important considerations.

Free and forced convection in conduits with asymmetric mass transfer, Gill, William N., Eduardo del Casal, and Dale W. Zeh, **A.I.Ch.E. Journal, 12,** No. 2, p. 266 (March, 1966).

Key Words: A. Mass Transfer-8,9, Heat Transfer-8,9, Convection -10,8, Free Convection-10, 8, Forced Convection-10,8, Pipes-9, Ducts-9, Calculation-8, Prandtl Number-6, Grashof Number-6, Asymmetry-6, Nusselt Number-7,2, Temperature Profiles-7, Rate-7, Mercer's Method-10.

Abstract: Approximate solutions for the thermal entrance region and a new exact solution for the fully developed region have been obtained for nonlinear, fully developed conduit flows with unsymmetrical transverse flow. Entrance region solutions are obtained by a generalized version of Mercer's method. The effects on combined free and forced convection of asymmetric mass transfer are studied, and a new exact solution is given which applies to such problems.

Simultaneous axial dispersion and adsorption in a packed bed, Chao, Raul, and H. E. Hoelscher, **A.I.Ch.E. Journal, 12,** No. 2, p. 271 (March, 1966).

Key Words: A. Axial Dispersion-8, 9, 7, Adsorption-8, 6, Mass Transfer-8, 6, 9, Simultaneous-0, Measuring-8, Calculating-8, 4, Rate-2, Peclet Number-2, 7, Dispersion Model-10, 9, Dispersion Constant-9, 7, Impulse-Response Method-10, Adsorption Column-9, Packed Bed-9, Charcoal-5, Activated-0.

Abstract: A study has been made of simultaneous axial dispersion and solid-fluid mass transfer in a packed-bed adsorber. Four different controlling mechanisms for the solid-fluid mass transfer rate are considered. An impulse-response technique was used to obtain simultaneously values for the axial dispersion and the mass transfer rate. The mathematical model used to analyze the results is a generalization of the dispersion model.

An analytical study of laminar counterflow double-pipe heat exchangers, Nunge, Richard J., and William N. Gill, **A.I.Ch.E. Journal, 12,** No. 2, p. 279 (March, 1966).

Key Words: A. Heat Transfer-8, 4, Forced Convection-10, 8, Fluid Flow-10, 8, Laminar-0, Counterflow-0, Countercurrent-0, Heat Exchanger-10, Concentric-0, Double Pipe-0, Calculating-8, 4, Eigenvalues-2, Expansion Coefficients-2, Nusselt Numbers-2, 9, Asymptotic-0, Temperatures-2, 9, Heat Transfer Coefficients-2, 9, Orthogonal Expansion-10, 9, Predicting-8, Using-8.

Abstract: An orthogonal expansion technique for solving a new class of counterflow heat transfer problems is developed and applied to the detailed study of laminar-flow concentric-tube heat exchangers. The exchanger problem is solved for fully developed laminar velocity profiles, negligible longitudional conduction in the fluid streams and in the exchanger walls, and with fluid properties which are independent of the temperature. Comparisons are made with single-stream solutions such as the Graetz problem, with empirical correlations of experimental data and with cocurrent flow exchangers.

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differences between models and prototypes which are difficult to estimate. Other major sources of information were vendors' catalogs—it has not been observed that vendors usually give away information they consider worth keeping—and AEC reports, with a strong preference for the authors' own works and those of their colleagues at Oak Ridge.

As their principal shell-side design tool the authors selected the 1958 correlation of Tinker. From 1958 until the preliminary 1960 correlation of the University of Delaware work by Bell, which in form supplements Tinker's, the Tinker correlation was the best available. However, it was well known in design-for-pay circles that the Tinker correlation frequently predicted extremely high pressure drops with as much as five- or tendfold errors. Even before the final University of Delaware report of January 1963, Bulletin No. 5, progressive design organizations had already modified their design procedures accordingly. With the appreciation that a book is not written overnight, it appears that there was more than enough time between 1960 and 1965 to bring the present text up-to-date in this important detail. The chapter on condensation never quite gets around to identifying the significant variables.

In the preface the authors indicate that the book is not intended as a teaching text, nor does it contain the exercise problems which usually go with a textbook. The book is intended as a reference for engineering graduates—albeit lacking the pedagogical unity which would be helpful for midnight-oil practitioners.

Other notable omissions include the role of the computer in modern heat exchanger design, particularly with regard to optimization. The latter term is used frequently in the text without anything being done about it.

The authors manifest particular relish for large wash drawings, photographs, and line drawings which scarcely appear compatible with the language of the engineering graduate. The large format of the book is quite readable but it also demonstrates that large pages can be wasted as readily on simple sketches and wash drawings as small ones.

The last one hundred pages of the book constitute a "Handbook Section" of charts and tables which the authors found useful in their work. Some of the charts and tables have been around for a long time, while others, such as unit costs of steel pipe, etc., hardly merit space.

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