concerned with sources of original experimental data for liquid mixture densities, gas or vapor mixture densities, Joule-Thomson coefficients (including pure component data sources), and calorimetric measurements. The format for each of the sections is the same: 1) a brief introduction, 2) a figure showing the availability of the data for binary systems, 3) a table describing the available data for binary systems, 4) a table describing the available data for ternary and higher systems, and 5) an alphabetic list of references. The tables describing the available data also include the temperature and pressure range and any pertinent remarks. No critical evaluation is made by the authors concerning the reliability of any reference. In some sections of the bibliography additional species are included in the survey that are not listed on the availability chart. Outside sources have been used in some cases to cross-check the references.

One point should be made concerning the accessibility of the data sources noted in this bibliography. Some recent bibliographies have, in the absence of reviewing the original data source, relied upon published abstracts for information and in doing so give no reasonable guarantee that the data are accessible by normal means. My experience with previous NBS bibliographies on cryogenic systems has been that the NBS Cryogenic Data Center is helpful in obtaining those data sources that are otherwise difficult to obtain. In addition the utility of the bibliography would be greatly enhanced if supplements were published periodically as new experimental data become available.

Research workers, design engineers, and others interested in the separation, purification, and liquefaction of cryogenic materials should welcome this book as a valuable addition to their reference collection.

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Thermodynamics of Fluids, K. C. Chao and R. A. Greenkorn, Marcel Dekker Inc., New York (1975). $29.75.

For those involved in teaching and learning chemical engineering thermodynamics on a graduate level, the need for new, modern and comprehensive text books is evident. Consequently, it is no surprise that several books were published in the last three years.

In the book considered here the authors present many of the key concepts and equations that a graduate student must learn in order to solve problems of equilibrium systems containing at least one fluid. In the five chapters the book presents basic physical and mathematical principles and some applications of them to gases, to liquid solutions, and to phase and chemical equilibria.

In the approach to equilibrium situations the book covers a wider range of situations than some of the recently published texts, although several important aspects, for instance the area of ionic systems, are not included.

The mathematics are well developed and presented. However, the presentation of specific subjects is not deep enough to always permit the student to recognize limits of applicability or to select one equation rather than another in a real design case. Moreover, if the book were to be considered as a text, it would have been desirable—even mandatory from this reader's point of view—for the relationship of empirical equations to the fundamental laws to appear in detail. Also, definitions of basic thermodynamic concepts should have been more precise. Accurate statements on developmental background, such as the Van der Waals theorem of the corresponding states, are instrumental to education.

The authors should have emphasized and reemphasized, especially in the first chapter, that thermodynamic processes are changes and that process thermodynamics deals with defining final conditions and exchanges of energy that result from these changes. Perhaps the biggest flaw, common also to some of the other books in the field, is the desire to present in book form an attempt to cover this diversified subject in a one-semester course. Thermodynamics is too fundamental to many aspects of chemical engineering to be adequately taught in one semester, as, unfortunately, is the case in most schools. In this reviewer's opinion books are not guided by administrative considerations and should present wider scope.

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Turbulence in Mixing Operations, Robert S. Brodkey, editor, Academic Press, Inc., New York, 1975, 339 pages.

This book presents a review of the advances in mixing operations involving laminar and turbulent flows with and without chemical reaction. An initial response to the book is that a discussion of the entire field of mixing is intractable. The papers are taken for the most part from the June 1974 AIChE symposium "The Application of Turbulence Theory to Mixing Operations." Although there is some redundancy, the authors do a remarkable review of the field.

Following an introduction, six major chapters are presented by separate authors. The first four cover the more theoretical aspects of turbulent mixing of reactants in a variety of apparati. Chapter V discusses simulation of turbulent field mixers and reactors and applications toward design. Chapter VI presents a helpful summary of turbulent mixing in industrial applications and outlines the major procedures for design in representative industrial systems.

For the chemical engineer concerned with industrial applications and design, a comprehensive reading of Chapter VI and the various references listed is essential. Thereafter, a review of Chapter V, which presents the major results obtained with the hydrodynamic mixing model, is recommended. This material includes suggestions for additional research in turbulent mixing in order to improve the credibility of the mixing process simulations. Readers who wish to examine the theory of mixing should study the remaining four chapters. Chapter II presents a comprehensive review of some aspects of the theory and supports that material with experimental comparisons for pipe flows, mixing vessels, and the multijet reactor. The review given in Chapter III on the nonpremixed reaction should be examined, with attention given to the experimental results.

As R. Clausius once said, "Es gibt nichts mehr praktisches als eine gute Theorie" ("there is nothing as practical as a good theory"). In the case of turbulent mixing, the delicate balance between experiment and theory with application to design is being effected. The use of the theory presented can aid the designer for mixer comparisons or scale up of equipment. It can provide an indication to the designer of what he does not know, whether experiment is justified, or whether a commercial unit should be purchased.

This is not a textbook but a review. It could be used as a resource for a special topics course at the graduate level. In general it is necessary for a reader to study many of the references cited to obtain a basic understanding of the material presented. In many respects the book is of paramount interest to chemical engineers engaged in chemical reaction analysis and engineering.

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ERRATA

In "Axial Distribution of Reactivity Inside a Fluid-Bed Contactor" by Shintaro Furusaki, Tatsuji Kikuchi and Terukatsu Miyauchi [*AIChE J.* **22**, 354-361 (1976)]:

1. The sentence following Equation (2) on page 355 should begin as follows. "*e* is expressed by . . . . . ".

2. On page 358, in the bracket, m should be m_c.

3. Caption for Table 1 on page 359 should be as follows: "Table 1. Effect of Fine Particles on Conversion, Catalyst 600 cm^3, $U_f = 30.5$ cm/s".