references listed to allow a search to continue for information that may be specifically needed. Each of the physical property chapters concludes with a brief recommendation of how to proceed with the correlations and estimates just reviewed. These recommendations are the most useful sections of the book. If the entire book was written in this critical manner, the book may have been more useful. As it is, a reader may be unsure about the relevance or importance of a correlation as presented without reading other literature on the subject.

Another disadvantage of this book is that the chapters are not categorized in a way to use the contents effectively. It would have been helpful to classify correlations as being applicable for dilute solutions or concentrated solutions, by electrolyte, and as being a theoretical or empirical expression. Each physical property chapter has to be read thoroughly to understand the relevance of the information presented. The book is poorly cross-referenced. For example, there is a chapter concerning activity coefficients; however, there are also discussions of activity coefficient correlations in the chapters on vapor pressure, diffusion coefficients, and osmotic coefficients. Although each chapter is self-contained, much information is repeated throughout the book. For many of the correlations the values of the empirical or property constants needed to utilize them are not given; therefore, the general relationships that are given would be difficult to apply to a specific solution.

A handbook of physical properties and correlations for aqueous electrolyte solutions would be extremely useful for scientists and engineers dealing with electrochemical systems. However, this book would be a disappointment for someone who reads the title and thinks a long-needed handbook of aqueous electrolyte solutions now exists. Workers who wish to quickly and easily find a correlation for a particular physical property would find it difficult to use. For the researcher or graduate student who needs a resource guide, this book may be a good reference to initiate a search in the literature for physical property correlations for an aqueous electrolyte solution.

Jan B. Talbot
Department of Applied Mechanics and Engineering Sciences
Mail Code B-010
University of California, San Diego
La Jolla, California 92093

Thermodynamic Data for Pure Compounds. Part A: Hydrocarbons and Ketones. Part B: Halogenated Hydrocarbons and Alcohols (Physical Sciences Data 25)

By Buford D. Smith and Rakesh Srivastava, Elsevier, New York, 1986, Part A:883 pp., Part B:999 pp., $294.50.

These data compilations are intended primarily to facilitate calculations of vapor-liquid equilibria in mixtures, i.e. to calculate pure-component vapor-phase fugacity coefficients and pure-component liquid-phase fugacities. Tabulated data are given for vapor pressures, saturated vapor volumes, saturated liquid volumes, enthalpies of vaporization and second virial coefficients. No data are given for heat capacities or for enthalpies and entropies of formation. No data are given for solids, superheated gases or supercritical fluids.

To facilitate estimates when data are not available, the following constants are given for many (but not all) listed compounds: critical properties, acentric factor, radius of gyration, melting temperature, normal boiling temperature and dipole moment; these constants can then be used as input data for well-known correlations. Finally, constants are reported for several well-known equations that give vapor pressure or liquid density as a function of temperature. Perhaps most useful, the authors give literature sources for every property tabulated.

The authors deserve thanks from the community of phase-equilibrium thermodynamicists for their painstaking work. These tabulated pure-component data will be useful for reduction (and subsequent correlation) of experimental vapor-liquid equilibrium data for mixtures.

J.M. Prausnitz
Chemical Engineering Department
University of California
Berkeley, CA 94720

Instrumentation and Control for the Process Industries

By John Borer, Elsevier, New York, 1985, 293 pp., $64.50.

Process Instruments and Controls Handbook, Third Edition

Edited by Douglas M. Considine, McGraw-Hill, New York, 1985, 1766 pp., $89.50.

These two texts cover the same subject area, namely measurement and control of process variables. The Borer text gives roughly equal coverage to measurement and control, while the Considine text devotes about 70% to measurement and 30% to control. If one could purchase only one of these texts, there is no doubt that the Considine text is the more desirable choice. The Considine text is significantly better in terms of its technical content and coverage.

In the measurement section of the Borer text, the basic variables, temperature, pressure, flow and level are discussed. The treatment is somewhat superficial and dated. A real problem with the text is the lack of any references at the end of chapters. If one would like to learn more about a particular technique, there is no place to go.

Two examples can be cited concerning the dated nature of the material. In discussing the selection of pressure measurement devices, Borer spends most of his time on Bourdon devices. One sentence is devoted to strain gauges. By way of contrast, Considine's text points out that strain gauges are the most common pressure transducer, considering all process related uses. Further, it is pointed out that strain gauges have made serious inroads on pneumatic technology in many applications. In the control section of Borer's text there is a chapter titled "Control Mechanisms." This chapter is devoted to a discussion of various bellows and mechanical linkages to achieve PID type control. Although they still exist in the field, the type of hardware discussed is being replaced by digital computer control systems. There is a discussion of pneumatic controllers in the Considine text as well. However, the emphasis in the Considine text is clearly toward digital control and instrumentation.

There is one serious error in the Borer text. In discussing the use of the relative gain for control loop pairing, the process gain and not the relative gain is used. This error appears both in the text and the accompanying illustrative example.

The Considine text gives very thorough coverage of the subject area. Detailed treatment of the basic measurements, temperature, flow, pressure, etc. are given as well as new approaches, fiber optics, on-line analytical instruments, thin film methods, etc. There are even discussions of machine vision and voice recognition. This handbook was written by over 140 specialists in the field and it

reflects their breadth of expertise. A large number of literature citations is given at the end of each section so that the reader can follow up on material.All practicing control engineers should have this handbook in their library; it is a real bargain. On the other hand, the Borer text can easily be omitted from one's library without a significant loss.

Thomas McAvoy
Department of Chemical
& Nuclear Engineering
The University of Maryland
College Park, MD 20742

The Chemistry of Coal

By N. Berkowitz, Elsevier, 1985, 513 pp.

This book covers a broad range of coal chemistry topics at a level of detail and degree of advancement that should serve as an introduction for engineers, scientists or graduate students not familiar with coal or as an overview and review for those already knowledgeable about some of the topics. The author of the book has long been a productive researcher in many areas of coal chemistry, and he describes authoritatively the well established information as well as the knowledge gaps.

The book is divided into four parts. The first part consists of three chapters on the history of coal chemistry, the diversity of coal in terms of its organic and mineral heterogeneities, and the methods used to measure chemical and physical properties of coal.

Part II begins with a chapter on coal as an undefined organic compound, including a presentation of physical properties and a discussion of the implications of elemental composition and evidence from function group determinations. Four other chapters discuss chemical reactions at electron-rich centers, including nitration, halogenation, oxidation and dehydrogenation, as well as acid- and base-catalyzed reactions, pyrolysis, and the action of solvents on coal.

Practical applications of coal chemistry are covered in Part III, with chapters on chemical aspects of direct combustion, carbonization, gasification, and liquefaction. A separate chapter on the environmental chemistry of coal discusses the nature of solid, liquid and gaseous pollutants and techniques for their control.

Part IV is presented as a postscript on the chemical structure of coal. Representations of coal structure are given along with a discussion of the significance of structural models and anomalous rank effects.

The main strength of the book is its coverage of coal chemistry from a scientific point of view. Thus the chemical characterization of coal and its reactions are extensively described in detail. The underlying experimental evidence for conclusions and remaining ambiguities are carefully given and identified.

A possible weakness of the book is the treatment of engineering aspects of coal chemistry. More often than not the chemical reactions of coal are coupled with transport processes that can significantly affect the behavior, be it softening and swelling or product yields, distributions, and overall reaction kinetics. While the book does offer valuable discussion of these physical influences, the treatment is not as quantitative as chemical engineers usually prefer. However, this possible weakness is more than offset by the many strengths of the book.

J. B. Howard
Dept. of Chemical Engineering
Massachusetts Institute of Technology
Cambridge, MA 02139

Synthetic Polymeric Membranes: A Structural Perspective, Second Edition

By R. E. Kesting, John Wiley & Sons, 1985, 348 pp.

The membrane field has grown significantly over the past fifteen years since publication of the first edition of R. E. Kesting's book that focused on membrane types and formation techniques. His recently published second edition includes updates on advances in membrane formation, material selection and membrane processes. The title to the new edition has been lengthened to include the words "A Structural Perspective," reflecting an expansion in the scope compared to the first edition. The substantially rewritten book seeks to make a direct connection between primary polymer structure and functional properties of membranes. Relationships between polymer molecular weight, molecular weight distribution, crystallizability and mechanical properties are integrated into discussions of membrane properties in Chapter 4. A discussion of polymer solutions has also been added in Chapter 5. This latter chapter has a strong practical tone with little quantitative theory; nevertheless, it contains many useful observations and rules to guide one in the art of successful membrane formation.

As in the first edition, there are no formal illustrative examples or problems, so it is not appropriate as a conventional text for academic instruction. The information covered, however, suits it well as a reference for researchers in advanced membrane materials or membrane formation development. Only a very short discussion of module configurations and packaging is offered in the introductory chapter of the second edition, and while such topics are not the primary focus, a bit more information here would have been nice. Also, more discussion of adsorptive fouling of membranes and how polymer structural features suppress or promote this problem would have been useful and well within the scope of the topic area. Overall, however, this book is highly recommended as an easily readable means of obtaining a deeper understanding of characteristics of membrane formation processes and of the types of materials currently available.

The point of view expressed by Kesting emphasizes the need for chemical engineers to understand polymer science in order to participate effectively in the evolving field of membrane science. Unlike traditional unit operations such as distillation and extraction, the detailed material properties of the medium from which the separation device is made enters *directly* into the separation process itself. Both polymer/penetrant thermodynamic interactions and polymer-controlled diffusion of the permeating species, governed by the membrane composition, determine the effectiveness of the unit operation.

Chapter three, dealing with miscellaneous membrane applications, is a nice addition to this expanded edition. This chapter treats cases falling outside the normal separation realm typically associated with membranes. Examples of such applications include: selective membrane electrodes, collector membranes for sampling, controlled release devices, membrane reactors, and solid state electrolytes. These new areas are based largely on the same fundamental principles as in conventional membrane separation situations. Such miscellaneous uses constitute a rapid growth segment of the