branes. Chemical engineering students with a knowledge of transport phenomena and a course in separation processes will be able to grasp this material readily.

In summary, I found *Polymer Science and Technology* to be worthy of consideration as a textbook for a polymer science elective for chemical engineering undergraduates. Problems are included at the end of each chapter, but not as many as in the latest edition of Rosen (1993) or in the new textbook by Grulke (1994). In terms of meeting the needs of undergraduates with a chemical engineering background, it is useful to compare Fried with Rosen and Grulke since all three books are written by chemical engineering faculty members. In the area of thermodynamics, both Fried and Grulke provide depth beyond the traditional Flory-Huggins treatment. Fried develops equation-of-state theories, while Grulke spends more time with the phase behavior of solutions and blends. In incorporating transport phenomena principles, both Rosen and Grulke provide more in-depth treatments of rheology, viscoelasticity, and processing than does Fried. On the other hand, Rosen does not cover diffusion in polymers, while Grulke does so within the context of devolatilization and drying and Fried uses membrane separations to discuss the topic. Lastly, in the area of reaction engineering, Rosen examines cumulative molecular weight distribution as a function of conversion, and Grulke covers different reactor types for polymerization in great detail. Fried describes polymerization techniques only briefly. The content of an introductory polymer course is certain to vary from instructor to instructor. Before adoption as a textbook, I recommend that this book be examined to determine if its coverage of topics is suitable for a given course.

Literature cited

Billmeyer, Jr., F. W., *Textbook of Polyer Science*, 3rd ed., Wiley, New York, NY (1984).

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Thermodynamics

By K. S. Pitzer, 3rd ed., McGraw-Hill, New York, 1995, xvi + 626 pp.

The book on thermodynamics by Gilbert N. Lewis and Merle Randall published in 1923 had a major impact in both chemistry and chemical engineering. It made such convenient concepts as fugacity and activity coefficient accessible and became popular with those who dealt with the real world of mixtures. Its usefulness has been demonstrated by its widespread use today. The success of this book led to a major revision and updating in 1961 by Kenneth S. Pitzer and Leo Brewer, the so-called second edition. Much of the original material in Lewis and Randall was kept, but much valuable new work was added. Among this was the work of Pitzer on corresponding states, which has proved so useful to chemical engineers and remains the basis of many of the most trusted correlations at the present time. Now, more than 30 years later, Pitzer has revised and updated the 1961 version of Pitzer and Brewer's book.

The early chapters of the book cover the standard material needed for students of chemistry or engineering: the thermodynamic laws, state functions and their interrelationships, entropy, chemical potential, fugacity, etc. There is a useful chapter in this early material on statistical thermodynamics, with emphasis on the interpretation of entropy and on properties of gases and crystalline solids. After this basic material, there are chapters on properties of real gases, followed by five chapters on solutions of various kinds. The remaining chapters, Chapters 15–28, are perhaps the most interesting to the teacher of thermodynamics, since they include topics not often found in other books. Reflecting the interest of the author, there are five chapters dealing with the thermodynamics of electrolytes, electrodes and electrochemical cells. There are also very useful chapters on: surface properties; statistical thermodynamics; low-temperature gases (hydrogen, helium, methane); systems in the presence of gravitational, centrifugal, electrical and magnetic fields; multicomponent solutions; biochemical systems; multicomponent solid-vapor systems; and irreversible processes. There are also 17 appendices, several of which will be of particular interest to chemical engineers. They include an appendix on property estimation, most of which details the Pitzer acentric factor and its use in the generalized corresponding states correlations of thermodynamic properties. Other useful appendices include those on equations of state, property behavior near the critical point (the scaling laws), and equations for mixtures (Wilson, NRTL and UNIQUAC equations).

This book will be of great value to most academic and industrial practitioners, as well as to students. It explains clearly not only the rudiments of the subject, but many applications that are not easily available in other books. The inclusion of elementary statistical thermodynamic treatments of many of the important concepts is also an attractive feature not present in standard chemical engineering texts.

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