(*Continued from page 319*)

vapor-liquid equilibria is difficult in the critical region because thermodynamic properties are strongly sensitive to small changes in temperature, pressure, and composition." Special equations are presented for computation of the critical properties of the mixture from pure component data and from correlating parameters obtained from experimental data on the binary systems. The modified Redlich-Kwong equation of state is employed for the estimation of the critical pressures.

No procedure for carrying out phase equilibrium calculations in the high-pressure region can be successful without its being able to handle partial molar liquid volumes. Failure to do so means that the effect of pressure on activity coefficients cannot be treated properly. As part of a very extensive coverage, practical methods for obtaining this thermodynamic property are presented.

The thermodynamic procedures developed in the book are compared to data on selected systems, but no overall statistical evaluations against a mass of data was made. When a comparable correlation, the Chao-Seader Equation, was published in recent years, it was tested against 2,700 experimental points. No such thorough examination was made of the subject techniques.

Constants for the polynormal expressions for the liquid fugacity are given for twenty components; the user of these methods will encounter difficulty in applications involving other substances, for example, carbon monoxide. Furthermore, such problems are enlarged because the book contains no index to assist the reader in finding the answers to questions which arise.

Whereas the book is certainly intended to be used as a second working right-hand by the practicing engineer, and to a large extent the authors are successful, there is a serious omission. The illustrations of the methods have been restricted to cases where the equilibrium conditions have previously been provided to the authors by published data. No discussion or accompanying computer programs cover the general case faced by a process engineer, where the self-same methods on a trial and error basis must be applied to *multicomponent* systems for which the equilibrium compositions of liquid and vapor must be obtained, as by a flash calculation. More than mere programming is involved.

In spite of these limitations the book is certainly a valuable addition to the field of thermodynamics.

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Kinetics of Chemical Processes, Michel Boudart, Prentice-Hall, Inc., Englewood Cliffs, N. J. (1968). 242 pages.

Not only does this book stress a realistic approach to reaction mechanisms, cautioning against too much faith in simplified concepts such as a uniform population of active centers, but it develops careful and precise statements of reaction rate, the steady state approximation, and the controlling step phenomenon in rate processes, which are helpful alike to the design engineer and the kinetics researcher.

The author first sets forth the basic concepts of kinetics, with definitions of transition state, rate and extent of reaction, and the ideal reactor types. In Chapter 2, the theoretical basis for rate expressions is presented, including a discussion of the effects of nonideality. The steady state approximation is developed, with great care, in Chapter 3. Next, kinetic models for homogeneous catalysis, chain reactions and polymerization are worked out in general terms.

Chapter 4 explains the concept of rate determining step so clearly that students should thereafter easily avoid the common sin of referring to the *slow step* of a reaction. Rate determining active centers are next defined. In logical sequence, Chapter 5 attacks the next stage of complexity: coupled sequences in reaction networks, to quote the chapter heading. Chain reactions in parallel and in sequence are analyzed.

The author is now in a position to expand his treatment of reaction models having a chain structure into acclerating, or branching chain reactions, in Chapter 6; following this with the companion topic, inhibition.

Now, in Chapter 7, the influence upon kinetics of mass and heat transfer processes is developed: including wall effects and penetration into porous catalysts or reactants.

In Chapter 8, "Correlations in Homogeneous Kinetics," the author discusses the Polanyi relation and the Brönsted relation as means of correlation, in series of reacting systems. Problems associated with extending the active center concept to heterogeneous catalysis are now treated in Chapter 9. Here the variable adsorption behavior of the surface is coupled with the concept of the compensation effect, an empirical correlation among rate constants and activation energies, to show that apparent compliance with a model which assumes uniform active centers cannot be taken as necessarily supporting so simple a model. This is a scholarly analysis, citing actual data, not presented to undermine a student's future belief in the attractive features of models built with uniform active centers, but rather to give him a little more sophistication, in the complex field of applied kinetics.

Chapter 10 introduces the student to modern methods of mechanism identification, such as Neiman's tracer technique. Wei and Prater's systematic analysis of the first order reversible network is described in detail, and illustrated.

This book is a valuable addition to the growing library of books in applied kinetics, which may be considered for texts. It would appear well suited to a course in kinetics for graduate students in chemistry and chemical engineering, and for undergraduates in a strongly science-oriented chemical engineering curriculum.

While the developments in the text are worked out in general terms, there are problems dealing with real systems interspersed in the text and coordinated with it, to aid the student in perfecting his understanding through participation. Bibliography entries at the ends of the chapters are accompanied with explanatory comments.

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