BOOKS

Principles of Solution and Solubility, Kozo Shinoda (Translated in Collaboration with Paul Becher), Marcel Dekker (1978), 240 pages, $17.50.

This book was originally written in Japanese in 1966 and revised in 1974. The English translation lies closer to the second edition than to the first. The text is a brief but coherent treatment of the theory of solutions which is suitable for both undergraduate chemists and chemical engineers. Several examples are worked out at the end of each chapter followed by only a few exercise problems with answers provided. The number of references cited is rather sparse.

Professor Shinoda was a major collaborator of J. H. Hildebrand in the development of regular solution theory which not surprisingly, is a major focus of the text. The first four chapters provide an introduction to solution theory including ideal solutions, dilute solutions, and regular solutions. Chapter 5 addresses the important topic of the estimation of the solubility of gases, liquids, and solids in liquids. The essential theory is presented and compared with a number of experimental results.

Subsequent chapters treat the enthalpy and entropy of solutions and discuss aqueous solutions, polymer solutions, surfactant solutions, and solubilized solutions. The final chapter is a summary which outlines and discusses the factors which control solubility. The breadth of application of regular solution theory is presented and the factors that determine solubility in such solutions are detailed. In addition some general viewpoints on solubility are presented including the effect of hydrophilic groups in making organic compounds more water soluble and the effect of excess solute in mixtures of isomers. Also solution by particular mechanisms as related to polymeric substances, colloidal surfactants, and water-soluble polymers is briefly discussed.

Because the book is a brief treatment of a relatively narrow area within thermodynamics, it is not suitable as the only required text in an undergraduate course. However, the book will prove valuable as a supplemental text.

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Fundamentals of Chemical Reaction Engineering, by Charles D. Holland and Rayford G. Anthony, 1979, Prentice-Hall International Series, 541 pages, $23.95.

Measures of a good textbook should include: (1) ideas presented in small packages building into larger, generalized theories or concepts, (2) all major ideas within a unit clearly highlighted, (3) many illustrative examples, (4) generous use of graphs and figures, (5) problems that are graded from easy to more difficult allowing the student to progress from recall to analysis, and finally to synthesis: the three learning levels. When I use these measures to assess the book by Holland and Anthony, I find that they did succeed in some chapters, but failed in others. Some of the earlier chapters suitable for an undergraduate course meet most of these requirements. The latter chapters of more advanced material do not. I feel that the text could have been improved by highlighting major concepts and generalities in concluding type formats that would tend to pull together major ideas within each chapter or subunit. Some of the material within the book seems more like a collection of loosely related topics obtained from past theses or student projects.

The notation used is a mixture of engineering and SI units which may cause the purists some difficulty. Some concepts seem to be shorted in the book; namely space time, space velocity, yields, selectivities, extent of reaction, and others. In some cases these are not mentioned at all and others only rather briefly.

The book probably has its greatest utility as an undergraduate, one-semester text with its limitation falling in those chapters that deal with complex reactions and in the energy balance chapter, Chapter VI. I can recommend this text to be used in a one-semester course for Chemical Reaction Engineering. In spite of the shortcomings outlined above I believe that the mix of generalized theory and notation with specific applications throughout the earlier chapters warrants consideration from those professors seeking a different text or from those in industry seeking a reference in the area. I would not recommend the book for use at the advanced level.

The advanced level material is contained in the last three chapters covering polymerization reactions, highly non-ideal solutions, and theory of reaction rates. Most of the material in these three chapters is given to the polymerization topics, however.

Chapter I is the usual introduction to the definitions and language of the subject. Chapter II introduces flow reactors at isothermal operation and is well done from the standpoint of developing the plug flow, perfectly mixed flow, recycle, laminar, and partial axial mixing reactor models.

Chapters III and IV introduce complex reaction systems and these two chapters are probably the weakest in

the book. There is a wanting to come to some sort of generalized conclusion in Chapter III, and Chapter IV comes over as being rather tedious with difficulty in coming to any generalized set of tools.

Chapter V addresses thermodynamics of chemical reactions and is a rather typical presentation as used in most textbooks. Chapter VI on energy balances is weak. The energy balances are initiated with the first law of thermodynamics and all the material is generalized throughout. There are no specific illustrative examples. Actually, Chapter VI could be combined with Chapter VII that does contain more of the applications part.

Chapter VIII is given to the fundamentals of heterogeneous catalysis. It is qualitative rather than quantitative in nature and is a rather cursory introduction to the topic. However, not much more can be covered in the typical one-semester course on the topic.

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The Scientific Basis of Flocculation, NATO Advanced Study Institute Series E: Applied Science—No. 27, edited by K. J. Ives, Sijthoff and Noordhoff International Publishers B.V., Alphen van den Rijn, The Netherlands (1978) 369 pp., ($33.50).

As outlined by Ives in the introduction, the aim of these proceedings is to provide the reader with a scientific basis of flocculation in liquids without any attempt to present the principles of practical design. The text comprises twelve chapters (excluding the introduction), each the result of a lecture presented by well-known participants at the NATO Advanced Study Institute on the Scientific Basis of Flocculation at Christ's College, Cambridge, U.K. held July 3-15, 1977.

The usual reservations and criticisms for multiauthored proceedings regarding continuity, style, symbols, and overlap prevail. The text does however cover a wide variety of subjects associated with flocculation of colloids in liquids. It should be useful to those readers desiring an updated review of the fundamentals of surface chemistry of colloids, kinetic theories, hydrodynamics, and the influence of inorganic salts and polymers on colloidal stability. The text also covers experimental methods for destabilization from concentrated and dilute suspensions, and several applications including water and wastewater treatment, sludge dewatering and mineral processing.

For students of Environmental Engineering this book should be especially timely since its theoretical bias complements the emphasis on design evident in a spate of new books devoted to Water and Wastewater Treatment. After all, understanding why (mechanism) in addition to how (design) elevates training to education.

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Fault Detection and Diagnosis in Chemical and Petrochemical Processes, by D. M. Himmelblau, Scientific Publishing Co., 1978, 414 pages, $59.50.

The size, system characteristics, economics and hazards of large chemical and petrochemical plants are now such that the penalties of inefficient operation due to fault conditions of plant downtime and of sudden failure are often serious. As a result there is considerable interest and activity in the development of improved methods of dealing with fault conditions, including the detection of incipient malfunctions. The important area of condition monitoring of process machinery has recently been described in *Mechanical Fault Diagnosis* by R. M. Collacott. The present volume is timely in presenting an overview of the whole field of fault detection and diagnosis with particular emphasis on the processing of the information obtained from detection and diagnostic systems. The successive chapters deal with the overall approach; with basic statistics, including error propagation, interval estimation and hypothesis testing; with process models, both deterministic and stochastic, continuous and discrete, including models based on physico-chemical principles, population balance models and empirical models; with process control charts, including Schewhart charts, cumulative sum charts and multivariable charts; with fault detection by state and parameter estimation using algebraic equations, ordinary and partial differential equations, difference equations, transfer functions, frequency response, time series and residence time distributions; with pattern recognition methods based either on template fitting or feature extraction and classification, including fault dictionaries and cluster analysis; and with information flow methods, including hazard and operability studies, failure modes and effects analysis, fault trees and cause-consequence diagrams. The treatment covers fault detection and diagnosis both by the process control system, i.e. process operator and process computer, and by trouble-shooting teams and deals both with design faults which become apparent during operation and with operational faults. The material is illustrated by synthetic or simulated and real-life examples, including reactors, distillation columns, liquid-liquid extraction columns, reboilers, heat exchangers and instrumentation. The book is intended to present analytical background and practical techniques; it is not a student textbook and does not contain tutorial problems. The chapters on statistics, modelling and estimation are fairly heavy mathematically. Essentially the book is a source book of ideas and techniques. It is valuable also as indicating practical applications of mathematical techniques. It does not deal with one of the central problems in this field, namely the overall design of the fault detection and diagnosis system. There is a large and increasing number of techniques available, but they all cost money. There is need for the development of criteria to guide the selection of individual techniques and the design of the system as a whole. This is not a criticism of the book, however; the work has not as yet been done. Current developments in algorithms for fault tree generation and, more generally, fault propagation are mentioned only briefly. Some particular aspects of fault detection and diagnosis not dealt with in any detail include pressure vessel inspection, nondestructive testing and acceptance standards; event trees; and Weibull analysis. These are comments, however, rather than criticisms. The author is to be congratulated on a most useful contribution to an important but somewhat neglected field.

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Measurement of Two Phase Flow Parameters, by G. F. Hewitt, Academic Press, Dec. 1978, $22.25; 287 pages.

The most useful travel guides are those written by travelers who have themselves experienced most of the trip. Hewitt's "guide to the world of gas-liquid flow measurement" is offered by an experienced traveler in that world. Few laboratories have provided as much experimental data in two phase flow as the Harwell group under Hewitt's leadership. Many modern two phase flow measuring methods originated in those laboratories and innumerable methods developed by others were evaluated and improved there. So this is a book by an investigator