

"Mechanism of the Oxo Reaction." They have sorted the various aspects of the complex history of hydroformylation chemistry admirably. Most of the useful tools of homogeneous catalysis are demonstrated, from molecular orbital theory to empirical kinetics to stereochemistry. The value of the stoichiometric reaction in the overall understanding of the catalytic *oxo* process is well documented. This paper nicely precedes the study of F. Paulik's review of "Recent Developments in Hydroformylation Catalysis." The combination of these two papers provides a thorough consideration of most aspects of homogeneous catalysis within the framework of a single system of process chemistry. Paulik discusses not only the most recent catalyst systems but also the effect of various process variables on the reaction system performance. His paper is concluded by briefly describing the performance of modified homogeneous catalysts which are mounted on porous solid supports.

The paper by R. J. Kokes entitled "Some Aspects of Catalysis: The P. H. Emmet Award Address" provides an excellent discussion of much of his own work in the hydrogenation of ethylene, the isomerization of olefins, and the oxidation of hydrocarbons. This is good recommended reading for anyone interested in heterogeneous catalysis. After reading Koke's paper the review of "Electron Localization and Oxygen Transfer Reactions of Zinc Oxide" by P. Roussel and S. J. Teichner provides a very effective transition from primary concern with the surface reaction to increased attention to the manner of surface involvement in the reaction. Many of the techniques described in these two papers are similar, and for students this reinforcement is helpful. Along similar lines the "Study of Kinetic Structure Using Marked Atoms" by John Happel develops the utility of isotopic tracer techniques along with the stoichiometric number concept of Horiuti in analyzing complex catalytic reaction systems. He reviews theory and experiments and then discusses the application of these tools to the ammonia synthesis, sulfur dioxide oxidation, carbon monoxide oxidation, and the dehydrogenation-hydrogenation of C_4 hydrocarbons.

Surface and support properties are considered in two papers. The first is by R. J. Cvetanovic and Y. Amenomiya, "A Temperature Programmed Desorption Technique for Investigation of Practical Catalysts." This experimental method, the apparatus and procedure, and the results for some typical systems are described. The authors anticipate that one of the principal uses of this technique will be in obtaining informa-

tion on the energetic heterogeneity of catalytic surfaces. The second paper in this area is "X-ray Scattering Techniques in the Study of Amorphous Catalysts" by P. Ratnasamy and A. J. Leonard. They discuss the radial electron distribution method and the interpretation of results in application to various catalyst supports.

In conclusion, the reader can turn to the very timely discussion of Frank Dwyer on "Catalysis for Control of Automotive Emissions." He reviews in a most convincing manner the current status in each of the various aspects of this problem. Where answers are currently unavailable he points this out. He considers the requirements and difficulties in each area and concludes that there "seem to be no published claims for catalysts that will survive 50,000 miles of use when the 1975 Federal standards are used as the criteria." Recalling our fictitious graduate student in his catalysis seminar, this conclusion should send him back to the laboratory with real problems to solve and much better prepared to tackle them for having invested the energy required to study this volume of Catalysis Reviews.

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Industrial Crystallisation from Solutions, Jaroslav Nyvlt. Transl. by Paul Feltham, Butterworth & Co., Ltd., London (1971). 189 pages. \$28.70.

This slim book first published in Czechoslovakia in 1967 has been extensively revised for this first English edition. It should prove interesting and useful to the chemical engineer and others who have to deal with the practical problems of crystallization from solution.

The author has tried to provide a ready reference and handbook to the practical aspects of industrial crystallization and has done a good job in the attempt.

Arranged in only two chapters, it covers Theoretical Foundations of Crystallization and Design Calculations for Crystallizer Installation.

While this may seem short for a book, each chapter is divided into numerous subdivisions. Chapter 1, while not as detailed as material to be found in other monographs, gives a good background in crystallization. Some of

the topics covered are phase equilibria, material and thermal balances, equilibrium diagrams, correlation methods for solubilities in multicomponent systems, kinetics of crystal growth, kinetics of crystallization, kinetics of nucleation, crystal habit, product purity, and product size distribution. Chapter 2 switches to the more practical aspects of crystallization covering various types and designs of crystallizers that are to be found in industrial practice. These cover stirred-batch and continuous crystallizers, series stirred, classifying and parallel-flow crystallizers, among others. Also covered are some types which are not normally found in U.S. industry.

Numerous examples, tables, and hints throughout add to the book's usefulness. Background equations are given along with a clear explanation without trying to go into detailed theory on each subject. References are given for those wishing a more theoretical discussion of the subjects.

Indeed, an outstanding feature is the profusion of references given throughout the book. Each subdivision has its own reference list of from 2 to 265 entries, and there also is an additional list of over 400 entries in regard to crystallization of various compounds listed in the appendix. A large number of these entries are 1968 or later, up to and including 1971.

While other well-known monographs exist on crystallization (Mullin, 1961; Van Hook, 1961; Bamforth, 1965), this book does not compete with but rather complements them. It was not intended to be an all-inclusive work and should not be considered as such. The author has done a very good job from the chemical engineering standpoint, and this book should find its place on the shelf of all those who are engaged in this field.

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Detergency: Theory and Test Methods, W. G. Cutler and R. C. Davis, (eds.), Marcel Dekker, New York (1972). 451 pages. \$28.50.

Is detergency significant to the chemical engineer? Of course his clothing, dishes, automobile, hair (if any) and skin are washed more or less frequently. Probably, however, he concerns himself less over these than about

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