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BOOK REVIEW

Rate Equations of Solid-Catalyzed Reactions. Edited by R. MEZAKI AND H. INOUE. Columbia University Press, New York, 1991. 420 pp. $140.00.

Rate Equations of Solid-Catalyzed Reactions, edited by Mezaki and Inoue, contains a comprehensive compilation of kinetic rate expressions for a large number of industrially relevant catalytic reaction systems. Mezaki and Inoue should be commended for their effort. For the practicing catalytic engineer the book should serve as a quick reference guide for assessing the functional dependence of rate on various operating conditions for a catalytic reaction system of interest. Even in this age of computer-aid literature searches this book should reduce the typically large activation barrier and search time associated with locating kinetic rate expressions for a particular reaction system. It is a recommended reference book for all whom are involved in the business of catalytic reactions. However, its format is not amenable for teaching.

The book is structured according to the reaction system type. Chapter (1) focuses on synthesis (e.g., of sulfur trioxide, ammonia, methanol), (2) on hydrogenations (e.g., of carbon monoxide, carbon dioxide, ethylene, cyclohexene), (3) on hydrogenolysis (of low molecular weight alkanes such as ethane and/or pentane), (4) on hydrocracking (of higher molecular weight components such as *n*-hexane and *n*-dodecane), (5) on dehydrogenation (e.g., of ethanol, ethane, cyclohexane), (6) on complete oxidation (e.g., of hydrogen, carbon monoxide, alkanes, and olefins), (7) on partial oxidation (e.g., of methanol, ethylene, xylenes, and ammonia), (8) on isomerization (e.g., of methane, ethane, and cyclohexane), (10) on decomposition of ammonia and nitric oxide, (11) on dehydration of various alcohols, (12) on cumene cracking, and (13) on other key reactions such as water–gas shift and nitric oxide reduction. In total, 98 reaction systems are compiled. For many of the systems the kinetics obtained with different catalysts are provided. For example, 24 different sets of kinetic data are provided for SO_3 synthesis on catalysts including unsupported V_2O_5, V_2O_5 supported on SiO_2 and Al_2O_3, and V_2O_5 promoted by alkali materials (e.g., K_2O, Na, K). For the partial oxidation of butane kinetics are provided for V–P–O, V–Mg–O, cobalt–molybdate catalysts. For reaction systems involving multiple overall reactions rate expressions are provided for the individual reactions. Finally, systems in which intermediate step mechanisms are offered the rates expressions and parameters of the individual steps are provided.

The kinetic rate equations provided are not altered or analyzed by Mezaki and Inoue. In most cases the editors provide the reactor type and range of operating conditions over which the kinetic models are based. Thus, several tasks are left to the user; these include (1) discriminating between rival kinetic models for a specific catalyst and reaction, (2) selecting the "best" catalyst based on the activity and selectivity data provided, and (3) assessing the quality of the data (e.g., truly differential? truly isothermal? truly without diffusional intrusion?). Regarding task (3), while the original research articles may not provide such information to carry out such an assessment, it is hoped that the users of this reference book make the effort to research these salient issues. Otherwise, the convenience afforded by this extensive compilation of kinetic rate models may be abused. Along these lines, by no means does the book teach kinetic modeling or catalytic chemistry. Thus, particular care should be taken if the book were to be used as a reference text in an undergraduate or graduate kinetics course.

The organization of the book is user-friendly. The Table of Contents at the front of the book is ordered by reaction system type. A convenient index in the back of the book is alphabetically ordered according to catalyst composition. Thus, the user can promptly access the reaction system and catalyst of interest.

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