BOOK REVIEWS

Chemical Kinetics and Catalysis

By R. A. van Santen and J. W. Niemantsverdriet, Plenum Press, New York, 1995, 280 pp., \$69.50.

I am going to comment on this book from the perspectives of three different groups of readers: beginning graduate students in catalysis, instructors who are considering it for use in a course, and catalytic researchers. The first group is probably the primary intended audience because the book evolved from a course taught at the Schuit Institute of Catalysis at the Eindhoven University of Technology in the Netherlands. At the same time, since the book is part of the *Fundamental and Applied Catalysis* series aimed at both academic and industrial researchers, it should also be of interest to the other two groups.

As a student I would enjoy reading Chapter 1 because it provides a nice perspective of catalysis through a brief discussion of its history, industrial relevance, and scientific subdisciplines. Chapter 2 presents rate equations for homogeneous and heterogeneous systems. By introducing the concept of reaction affinity, the authors do a nice job of showing the relationship and consistency between thermodynamics and kinetics in situations that are either near or far away from equilibrium. Chapter 3 is not as easy to read because in trying to survey catalysis by metals, oxides, and sulfides in 32 pages, the authors bring together many seemingly unrelated facts without providing a structure to help understand them. Chapter 4, the core of the book, emphasizes the use of microscopic principles in estimating rate parameters. The strength of this chapter is that it introduces collision and transition-state theories for both homogeneous and heterogeneous systems. This combined coverage, not usually done in kinetics texts, enables one to appreciate the analogy between reaction intermediates and surface complexes. Chapter 5, titled "Medium Effects," basically deals with the effect of energy exchange on reaction rates, but touches on surface inhomogeneity that is caused by lateral interactions between adsorbates. Chapter 6 attempts to integrate the concepts presented in the first five chapters and provides a microscopic viewpoint of heterogeneous catalysis. This chapter does provide some useful insights into surface-catalyzed reactions, but most of its sections are about kinetic modeling and not about application of the transition-state theory.

As an instructor I would consider using this book as a text in a graduate-level course that is devoted to kinetics. It needs to be supplemented with another book for a graduate-level course that is supposed to cover both kinetics and reaction engineering, as is commonly the case in many chemical engineering departments in the U.S. And despite its title, this book cannot be used alone in a special topic course on catalysis because there is no coverage on two key components of catalysis, namely synthesis and characterization. Readers who are interested in these two topics will need to turn to the other volumes in this series published by Plenum Press. Regardless of the nature of the course, this book's attractiveness as a text could be enhanced by the inclusion of homework problems and more extensive referencing. With some exceptions (mostly on tables and figures), all the references are now grouped together at the end of the book. This arrangement makes it difficult to do specific and selective follow-up reading, which an instructor may wish to do in preparation for class notes.

As a catalytic researcher I am happy to see the comprehensive and authoritative treatment of this book in providing a microscopic understanding of catalytic reactions. One topic that I would like to see more discussion on is kinetic modeling of surfaces that have a heterogeneous distribution of sites. Currently inhomogeneity is dealt with only in Section 5.7 within the context of adsorbate interactions. I would also welcome more examples showing the application of microscopic principles to industrially relevant reactions, or examples showing the development of new catalytic materials and technologies based on these principles. Such examples will demonstrate the power of microscopic theories as predictive tools as well as provide clear-cut procedures for applying them.

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La Combustion et les Flammes

By Roland Borghi and Michel Destriau, Editions Technip Paris cedex 15, 1995, 365 pp., 550 Fr. franc.

A new book, written in French by Roland Borghi of the University of Rouen and Michel Destriau of the University of Bordeaux, is a timely addition to the field of combustion literature. I cannot find a better way of characterizing the book than to translate the introductory remark of the publisher: "The book is intended primarily for students but also for engineers, professors, and researchers who desire to become acquainted with the field of combustion. Professionals in the field will find this book to be useful in view of the current global trend that takes into account mechanical, thermal and chemical aspects of engineering simultaneously."

After an introduction which gives a panorama of the applications of combustion in our modern society, the book starts with three chapters devoted to the fundamental aspects of combustion. Chapter 1 sets the base of the thermodynamics of combustion. Chapter 2 deals with chemical kinetics and introduces the notion of elementary reaction and of chain reaction. Chapter 3 is devoted to the physical phenomena of heat transfer and mass transfer. This chapter culminates with the demonstration and statement of the conservation equation of the aerothermochemistry. At this point, an original and instructive application of these equations to the famous diffusion-flame problem of Burke and Shumann is presented. The chapter ends with the generalization of the conservation equation to turbulent flow.

The road is now open to cover the theory of combustion and flames phenomena of various complexity. Chapter 4 deals with explosion in closed vessels. Chapter 5 considers flames in laminar flows, first premixed flames and then diffusion flames. These are mainly laboratory experiments for the study of flame structure and measurements of flame velocity. Chapter 6 on turbulent flames deserves special attention, since it is the field in which one of the authors (Borghi) is engaged actively in research. The chapter is specially well-documented and could also serve as a review article on the subject. Chapter 7