

BOOK REVIEW

Kinetics of Chemical Processes. By Michel Boudart. Prentice-Hall, Inc. New Jersey, 1968. ix + 246 pp. \$7.50.

The reader will find few mechanistic interpretations in this book based on the nature of specific intermediates or active sites, for the author has aimed to give a generalized treatment which introduces at the senior or graduate level only broad concepts and theories of chemical kinetics. In the author's words, he aims to "explain the concepts associated with the kinetic study of the chemical process A goes to B goes to C." And he defends his aim: "It may seem unfortunate that components A, B, and C have neither odor nor taste nor color. But if they did, the subject matter of this book would be chemistry and not chemical kinetics." The author has fulfilled his aims successfully in the reviewer's opinion. He has succeeded in giving considerable unity and generality to the quantitative treatment of his subject. And this fits the definition of science. When the student discovers that in chemical kinetics, as in all branches of science, theories and concepts are not without exceptions, he should still find the guiding principles of this book useful.

Chapters 1 and 2 are introductory in nature, dealing with topics such as the extent of reaction, properties of the reaction rate expression, reactions in static and flow reactors, elementary reaction steps, transition-state theory, collision theory, thermodynamic formulation of rates, and the Arrhenius equation. In Chapters 3, 4, and 5, homogeneous reactions and reactions catalyzed at solid surfaces are given a common treatment. The steady-state approximation for a first-order sequence of reactions is introduced in Chapter 3 and followed in Chapter 4 by a discussion of simplifications which result from assuming a rate-determining step or a rate-determining active center. In the case of catalytic reactions on solid surfaces, these procedures lead to Langmuir-Hinshelwood kinetics which are at least useful for engineering correlations. The author defines an active center as "any reactive intermediate intervening between reactants and products in a single reaction, though not appearing

in the stoichiometric equation for reaction"—a broad definition which includes as a special case catalytically active spots on a solid surface. The author realizes the ambiguities in mechanistic interpretations which can result from using simplified kinetics, and he is also aware of the hopelessness of employing complete rate expressions at the present time. Chapter 5 discusses complex reactions in parallel and in series where coupling may occur when two or more compounds react with a common reactant or on the same catalyst.

In Chapter 6, autocatalysis and inhibition are considered, where the steady-state approximation apparently fails. And in Chapter 7, the author deals with what he calls *irreducible* transport phenomena, which excludes problems where flow is an essential component of the situation, but includes effects due to irreducible coupling between molecular diffusion of heat or mass and the chemical reaction, such as gel and cage effects, wall effects, and penetration effects. The reader may wonder why pore diffusion is neglected, irreducible or not, since it is frequently limiting in heterogeneous catalytic reactions. Undoubtedly, the author has shown good judgement in excluding this topic from an elementary, generalized treatment of homogeneous and heterogeneous kinetics.

Chapters 8 and 9 treat a few special topics of homogeneous and heterogeneous kinetics, respectively, which reflect their peculiar characteristics and cannot be treated in common. Among these topics are the correlations between activation energies and heats of reactions, and the problems of a nonuniform surface. Chapter 10 penetrates deeper into the analysis of coupled reactions started in Chapter 5. An excellent resumé of the method of Wei and Prater is given.

In conclusion, this book presents an excellent contour of chemical kinetics, well worth the price for serious students of the subject as well as for those wishing only a panoramic view.

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