Book Reviews *

Unimolecular Reaction Dynamics: Theory and Experiments. By Tomas Baer (University of North Carolina) and William L. Hase (Wayne State University). Oxford University Press: New York. 1996. vi + 438 pp. $75.00. ISBN 0-19-507494-7.

Three classic books have been written on the topic of unimolecular reactions: Forst, *Theory of Unimolecular Reactions*, 1973; Robinson and Holbrook, *Unimolecular Reactions*, 1972; and Gilbert and Smith, *Theory of Unimolecular and Recombination Reactions*, 1990. In recent years, however, many improvements have been made in preparing reactants with known energies, determining product state distributions, and following unimolecular reactions in real time. There have also been a number of theoretical breakthroughs. These recent advances are covered well in this excellent new book.

The authors bring complementary expertise to this book. Tomas Baer is an experimentalist who works primarily with ions, and William Hase is a theoretician with considerable experience with neutral systems. Because of this, both experiments and theory are treated in considerable depth in this book. In addition, each chapter contains many references to the original literature.

Many of the chapters cover standard topics in unimolecular reactions from a modern perspective. Thus, Chapter One (Introduction) gives a brief historical survey, Chapter Two (Vibrational/Rotational Energy Levels) summarizes recent work such as variational calculations of vibrational states and semiclassical calculation of energy levels, and Chapter Three (Potential Energy Surfaces) discusses reaction paths, *ab initio* calculations of surfaces, and electronically excited states. The theory of unimolecular reaction rates is well covered in several chapters beginning with Chapter Six (Theory of Unimolecular Decomposition - The Statistical Approach) which contains an excellent section on various ways to compute the density and sum of states. This chapter also develops the RRKM theory and its classical RRK counterpart. The contribution of the reaction degeneracy σ, a concept I always find confusing, is well treated in section 6.5. Chapter Seven (Applications and Extensions of Statistical Theories) covers such topics as anharmonicity effects, different types of transition states, the role of rotations in dissociation, variational transition state theory, phase space theory, the statistical adiabatic channel model, and tunneling. Each theoretical method is described clearly, and many comparisons between theory and experiment are given in Chapters Six and Seven. Other theoretical approaches are treated in Chapter Eight (Dynamical Approaches to Unimolecular Rates) including quantum resonances, quantum beats, classical dynamics, and electronically nonadiabatic processes. There is also a discussion of experimental studies of state-specific unimolecular dissociation. Finally, Chapter Nine (Product Energy Distributions) discusses in great depth the various ways to calculate product energies. The theoretical chapters as a group represent a real tour de force. Essentially all of the theoretical methods used to treat unimolecular reactions are presented clearly with many references to the original papers.

Experimental methodology is presented in two consecutive chapters in the book. Chapter Four (State Preparation and Intramolecular Vibrational Energy Redistribution) covers the two title topics in great depth. The consequences of the experimental reality that a pulsed laser will prepare a coherent superposition of internal states is discussed, and this is followed by the best summary of IVR that I know. Chapter Five (Experimental Methods in Unimolecular Dissociation Studies) is the longest chapter in the book and is very comprehensive in its coverage. Hitting only a few highlights, I enjoyed the sections on vibrational cooling of molecules in a supersonic expansion, stimulated emission pumping, photoelectron−photoion coincidence experiments (PEPICO), real-time measurements of dissociation of neutrals and ions, and correlations in unimolecular dissociations. The book concludes with Chapter Ten (The Dissociation of Small and Large Clusters) which describes experimental and theoretical studies of this interesting class of molecules.

From start to finish this book is excellent. The authors are to be commended for their efforts. Anyone working in this field or in related fields will want to own this book.

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Handbook of Plastic and Rubber Additives. By Michael and Irene Ash. Gower: Brookfield. 1995. xxii + 1322 pp. $350.00. ISBN 0-566-07594-6.

This handbook describes more than 13 000 trade name and chemical additive ingredients that are used for the formulation of plastic and rubber products. The information has been gathered from more than 1200 worldwide manufactures, their subsidiaries, and distributors. This reference expedites material identification for the user by cross-referencing trade name products by chemical composition, function, CAS number, and EINECS number. The book is divided into four sections: (Part I) Trade Name Reference; (Part II) Chemical Dictionary/ Cross-Reference; (Part III) Functional/Cross Reference; (Part IV) Manufacturers Directory. The appendices contain the following cross-references: CAS Number-to-Trade Name Cross-Reference; CAS Number-to-Chemical Cross-Reference; EINECS Number-to-Trade Name Cross-Reference. There is a demonstration disk for the electronic version of the reference included.

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Thermal Methods in Petroleum Analysis. By Heinz Kopsch (Technical University of Clausthal). VCH: New York. 1995. xii + 515 pp. $170.00. ISBN 3-527-28740-X.

This reference book demonstrates the applicability and limitations of thermoanalytical methods in the investigation of petroleum products. The specialized data are the result of twelve years of thorough research. This book explores important petroleum topics such as the methods used in researching petroleum and its products; the reaction central to various refinery processes, tertiary oil recovery, lubricant stability testing, and oil shale retorting; and recent developments in instrumentation. Also hard- and software are recommended, and advice concerning experimental practice is offered. Complete coverage of the methods employed in obtaining thermodynamical data, in particular thermogravimetry, differential thermal analysis, and differential scanning calorimetry, is presented with the appropriate underlying theories. Data obtained from model substances (i.e., pure hydrocarbons) are displayed, and how multicomponent hydrocarbon systems may be characterized by comparison of their data is explained. With an extensive list of equipment suppliers, this volume is a must for all scientists, engineers, and technicians working on research, product characterization, process development, or quality control in the oil recovery, oil refining, petrochemical, lubricant, and asphalt industries. There are 236 tables, 284 diagrams, and 159 references.

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Desk Reference for Organic Chemists. By Michael B. East (FAR Research, Florida) and David J. Ager (NSC Technologies, Illinois). Krieger: Malabar. 1995. 496 pp. $64.50. ISBN 0-89464-818-7.

The contents of this reference book are divided into six chapters which include Chemical Acronyms, Physical Acronyms, Glossary of Organic Stereochemical and Synthetic Terms, Named Reactions, Named Reagents, and Review References.

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*Unsigned book reviews are by the Book Review Editor.