Book & Media Reviews

Unimolecular Reaction Dynamics: Theory and Experiments

Tomas Baer and William L. Hase. Oxford University Press: New York, 1996. 438 pp. ISBN 0 19 507494 7. $75.

The subject of unimolecular reactions is a complex and wide ranging one—so much so that it is difficult to envisage a text that covers all aspects of the field yet still fits in a backpack or briefcase. Baer and Hase have limited their subject matter to theory and experiments relating to state- or energy-selected unimolecular dissociation reactions and have created a remarkably wide-ranging and balanced account of the central issues, state of the art experiments, and theoretical methods in this area.

The book begins with a historical introduction, which is followed by a basic summary of rotation/vibration bound states and potential energy surfaces. Then two of the central issues in energy-resolved experiments—what is meant by "state selectivity" and the ramifications of intramolecular vibrational redistribution (IVR) with respect to this—are addressed in Chapter 4. This is a gem of a chapter, and a particularly apt contribution to the textbook literature of the field. Chapter 5 contains a summary of experimental techniques that is admirably concise yet still encompassing. Chapter 6 briefly details statistical theories and benchmark experiments designed to test the fundamental statistical postulates. Chapter 7 discusses some of the basic tools and methodologies for applying statistical theories to compute microcanonical dissociation rate coefficients, together with selected theoretical studies. Exact dynamical quantum and classical descriptions of unimolecular decay are summarized in Chapter 8. In particular, this chapter has a nice discussion of resonances and mode specificity with reference to some of the key studies that have contributed to our understanding of these topics. Chapter 9 details standard models for predicting product state distributions, and the book is closed out in Chapter 10 with a description of theory and experiments on the dissociation of clusters.

The authors have a penchant for sub(.sub.sub!)sections, which can be distracting, but is understandable given the wide range of material they have included in the text. The referencing is generally extensive and will make the book a particularly useful access point to the literature. Although the book contains some illuminating discussions as indicated above, I feel that the breadth of coverage attempted (even given the limitation to state- or energy-selected topics) has sacrificed to some extent the pedagogical clarity of the text. Newcomers to the field (students or otherwise) will not find it easy to learn principles and practice from this text alone; nor is the primary literature referenced suitable for this purpose. This was a central focus of the Gilbert–Smith text, though the latter clearly sacrificed breadth of coverage to achieve it.

In conclusion, the authors are to be congratulated and thanked for a timely and important contribution to the textbook literature in the field of unimolecular reactions. They have produced a remarkably balanced and integrated account of both experiment and theory, which is already becoming a standard reference for workers in the field.

Sean Smith
Senior Lecturer, Department of Chemistry
University of Queensland
Brisbane, Qld 4072, Australia