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BOOK REVIEWS

Advances in Gas Phase Ion Chemistry. Volume 4. Edited by Nigel G. Adams and Lucia M. Babcock (University of Georgia). Elsevier: Amsterdam. 2001. xiv and 315 pp. $184.50. 0-444-50929-1.

This book contains a collection of seven chapters on topics related to gas-phase ion chemistry, ranging from topics that are applied, such as the chapter on proton-transfer reaction mass spectrometry, to those that are fundamental, such as the chapter on hypervalent bonding in anions. The chapters are uniformly well-organized, clearly written, and thoroughly referenced. They are also quite specialized, so this book should not be viewed as a general reference.

Chapter 1 covers proton-transfer-reaction mass spectrometry, a method of quantitating analytes based on a kinetic analysis of the reactions of the analytes with H_3O^+. Applications range from environmental ones to those related to food research and medical areas. Examples of proton-transfer-reaction mass spectrometry are presented for the quantitation of volatile compounds from lettuce, for example, and for monitoring isoprene concentrations in exhaled breath to determine blood cholesterol levels. The chapter is easy to follow, and the figures are excellent visual aides.

The second chapter is focused on the measurement of bond energies in hypervalent anions by using a flowing afterglow-tandem mass spectrometer. The anions described include trihalides and some phosphorus halides. In addition to a detailed analysis of these systems, periodic trends related to the type of the central atom, the types of bonded atoms, and the number of bonded atoms are discussed. The introductory section on hypervalent bonding is outstanding, and the chapter as a whole, although narrowly focused, is nicely organized.

The study of ion−molecule kinetics at high temperatures in a flowing afterglow instrument is reviewed in the third chapter, with numerous examples of the influence of temperature on rate constants. Ion−molecule reaction systems include some that are relevant to the ionosphere, such as the reaction of O^+ with N_2 or O_2, and reactions involving methane or aromatic hydrocarbons. The chapter closes with an informative summary of the influences of vibrational, rotational, and translational energies on rate constants.

Chapter 4 includes a description of vacuum UV, UV, and visible emission spectroscopic studies of the formation and reactions of small rare-gas cluster ions by flowing afterglow methods. The specialized flowing afterglow apparatus is briefly described, but most of the chapter is devoted to a review of the electronic structures and reactions of rare-gas cluster ions, such as $ArKr^+$, $HeNe^+$, and He_2^+. This chapter is presented at an advanced level and includes 200 references.

In Chapter 5, the applications of ion storage rings for preparing vibrationally cold molecular ions for subsequent reactions is reviewed. This chapter opens with a nice overview of the types of electron/molecular ion reactions and a description of storage rings, systems that contain ion sources, acceleration devices, and the confinement device. The examples emphasized include dissociative recombination of H_2^+ and O_2^+ and resonant ion-pair formation reactions of H_3O^+ and D_3O^+. One of the best sections of this chapter is a concise summary of the main merits of using ion storage rings for studies of electron-molecular ion interactions, giving an informed perspective to readers new to this area.

A review of the methods used to analyze neutral products from ionic gas-phase reactions and examples of specific applications is covered in Chapter 6. The electron bombardment flow reactor and radiolysis methods are described in this context, with numerous examples of the types of organic ionic gas-phase reactions, specifically ones involving cationic rearrangements, that can be investigated by using these methods. This chapter is packed with examples that are well-supported by clear, yet detailed, schemes.

The final chapter covers the topic of multipole-bound molecular anions, systems consisting of electrons weakly bound to molecules. This chapter includes an overview of electron binding to elementary particles, a synopsis of the history of the discovery of electron binding to molecular dipoles and quadrupoles, and a summary of experimental methods used to produce and study the anions. Several examples of Rydberg electron-transfer reactions to produce dipole-bound anions, including carbon clusters, MgO clusters, and nitrobenzenes, are given. This chapter covers a lot of material and could have benefited from a concluding section or some insights into the future avenues of this area.

Overall, the book is an interesting and expertly written compendium with numerous references for those seeking a deeper understanding of the material. This book will be most appreciated by those with an advanced background in gas-phase ion chemistry.

Jennifer S. Brodbelt, *University of Texas*

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