Ionic Processes in the Gas Phase

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Ionic Processes in the Gas Phase

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DEDICATION

To J. L. Franklin and Henry M. Rosenstock

This volume is jointly dedicated to the memories of two of the preeminent pioneers of research in ion chemistry, J. L. Franklin and Henry M. Rosenstock.

Shortly before the beginning of the proceedings which are the subject of this book, the participants received word of the death of Joe Franklin. Many of those present for the N.A.T.O. ASI in Portugal had heard Professor Franklin deliver the introductory lecture at a N.A.T.O. ASI on "Interactions between Ions and Molecules," held eight years earlier in Biarritz, France, and it seemed particularly appropriate that the group of his colleagues and friends assembled in Portugal honor him by dedicating this volume to his memory. Joe Franklin received his Ph. D. in physical chemistry from the University of Texas in 1934, and went to work for the Humble Oil and Refining Company at Baytown, Texas, where he remained until joining the faculty of the Chemistry Department at Rice University in 1964. In the early 1950's, he became active in the then-emerging field of mass spectrometry, and, in collaboration with Drs. Frank Field, Fred Lampe, and Burnaby Munson, carried out much of the significant pioneering work on ionization potential and appearance potential measurements and on ion-molecule reactions. In 1957, there appeared "Electron Impact Phenomena" by F. H. Field and J. L. Franklin, the first really comprehensive treatise on the subject of ion chemistry. In more recent years, he has continued to make so many important contributions to every area of the field that it would be difficult or impossible to name them all here. It is likely that most readers of this volume will have some personal familiarity with the work of Joe Franklin since his name is, and will continue to be, synonymous with ion chemistry.

One of the participants at the N.A.T.O. ASI on "The Chemistry of Ions in the Gas Phase" in Portugal was Henry M. Rosenstock, who had helped to organize the ASI. In the early 1950's when Joe

Franklin was beginning his work in mass spectrometry, Henry Rosenstock was a graduate student at the University of Utah, working on developing a theoretical picture of the dissociation of ions under collision-free conditions. The resulting Quasi-Equilibrium Theory, or so-called QET, is still an important tool for ion chemists, referred to many times in the proceedings of the ASI. After receiving his Ph. D. in 1952, Henry Rosenstock worked for several years at the Oak Ridge National Laboratory and in private industry before joining the National Bureau of Standards in 1960, where he directed a research team working in the areas of photoionization mass spectrometry, and, later, photoion-photoelectron coincidence measurements. From 1966 to 1968 he served as chairman of the American Society for Testing Materials Committee E-14 on Mass Spectrometry. He was succeeded as chairman by Joe Franklin, and together, they shared a large part of the responsibility for the establishment and early leadership of the American Society for Mass Spectrometry, now a major professional organization for scientists in the field of ion chemistry. In 1963, Henry Rosenstock initiated a program of compiling and evaluating data on ion thermochemistry, building initially on a small compilation which had appeared as an Appendix in Field and Franklin's "Electron Impact Phenomena." The initial publication resulting from this effort in 1969, "Ionization Potentials, Appearance Potentials, and Heats of Formation of Gaseous Positive Ions" by J. L. Franklin, J. G. Dillard, H. M. Rosenstock, J. T. Herron, K. Draxl, and F. H. Field, is still the most widely cited single publication in ion chemistry. Henry Rosenstock participated actively and enthusiastically in the proceedings in Portugal, sitting in the front row at every lecture, asking questions and making comments, and obviously enjoying himself very much. On the morning of Tuesday, September 14, 1982, he suffered a heart attack and died that afternoon shortly after being taken to a hospital in Lisbon. His death, no less than that of Joe Franklin, will be felt by the ion chemistry community of the world as a great loss.

M.A. Almoester Ferreira
P. Ausloos
R. Botter
A. Ferrer Correia
K. Jennings
S. Lias

PREFACE

The field of gas phase ion chemistry has undergone spectacular growth and development in the last decade. New experimental techniques have developed and theoretical advancements in quantum chemistry and chemical dynamics have begun to provide quantitative information, deeper insights and important guideposts for experiments. The growing interaction between theoreticians and experimentalists is yielding scientific information of both basic and applied significance.

The NATO Advanced Study Institute on Chemistry of Ions in the Gas Phase held at Vimeiro, Portugal, from 6 to 17 September 1982 took place four years after the 1978 Advanced Study Institute on Kinetics of Ion-Molecule Reactions held at la Baule, France. New theoretical approaches and experimental techniques developed since then are included in this book. Fundamental aspects concerning the kinetics and dynamics of formation and decomposition of gaseous positive and negative ions, their structural characterisation, energetics and thermochemistry are also discussed. In addition, some recent innovative developments in the areas of photodissociation, multiphoton ionisation, photo-electron-photoion coincidence spectroscopy, selected ion flow tube technique, and other techniques will be found.

The success of the NATO Advanced Institute on Chemistry of Ions in the Gas Phase was mostly due to the high quality of the lectures, panel sessions, research review contributions and the ensuing important discussions which would informally continue after the scheduled sessions. All the participants were ultimately responsible for the attainment of the aims of the Institute.

I would like to express my appreciation for the great assistance and support I always received from the members of the Organising Committee P. Ausloos, R. Botter, A. Ferrer-Correia, K. Jennings and S. Lias. I am very grateful for the efforts and enthusiastic help of my research group in the organisation of the meeting and for the efficient secretarial work of Mrs. Isabel Freire who also helped with the typing of parts of this book.

On behalf of all the participants I want to thank the Scientific Affairs Division of the North Atlantic Treaty Organisation whose grant made it possible to organise the meeting. Financial support from Instituto Nacional de Investigação Científica, Portugal, and student travel grants from the National Science Foundation, USA, are also gratefully acknowledged.

Finally I should like to mention the understanding and valuable guidance I always found in Dr. Mario di Lullo and in Dr. Craig Sinclair of the Scientific Affairs Division of the North Atlantic Treaty Organisation.

Lisbon, May 1983

M.A. Almoester Ferreira