to be the case for almost all later permit interventions, the deeper reason was ideological. The reader will be interested in comparing the ideological conflict of 1956 with that of today's pro- and anti-nuclear advocates. Details of testimony and an editorial by the *Wall Street Journal* (Appendix I) on the significance of the hearings are of considerable interest. After a long legal battle, in June 1961, the U.S. Supreme Court reversed the Court of Appeals and confirmed the AEC construction permit.

In the meantime, the reader will find that design and construction proceeded—this is covered with excellent graphics and photographs in Chaps. 8 and 9. Chapter 10 describes testing and preoperation. In October 1962, the ACRS notified the AEC that Fermi would be operated safely up to 1 MW(thermal). Next, there was a sodium-water reaction due to a small leak in the No. 1 steam generator. The 1-MW(thermal) license was finally issued in May 1963, and, finally, a license for operation up to 200 MW(thermal) was issued December 1965. Operation at 100 MW(thermal) began in July 1966. After some successful long runs at 100 MW(thermal) [22 MW(electric)], a fuel-melting incident occurred on October 5, 1966.

The fuel-melting incident, its prologue, aftermath, diagnosis, repair, consequences, and cost are given in Chap. 11. This account gives the reader an unusual nuclear detective story of the search for the cause of the difficult-to-detect meltdown. It is left to the reader to discover the cause and be apprised of the lessons learned.

In about four years, Fermi-I was put back into operation and went to a power level twice that at which the accident occurred (Chap. 12). However, by this time technology had made its relentless progress—a uranium-plutonium oxide fuel core had been found best for fast breeders. The uranium-molybdenum alloy fuel core of Fermi-I was obsolete and costly to retrofit.

The difficult decision of decommissioning was made as described in Chap. 13. Four more chapters of the book give an excellent account of safety at Fermi, nuclear and nonnuclear research and development, and also the educational contributions of Fermi.

The book ends (Chap. 18) with a review of the significance of Fermi. The project set many precedents and provided extended (12 years) experience with the maintenance of large sodium systems.

One of the principal purposes of the project, from the beginning, was to provide training. This was extended to more than 250 U.S. and foreign personnel.

The reader may perceive that the published results of the project and the training of scientists and engineers of other countries were perhaps the greatest contribution of Fermi-I. This was in consonance with the goal of President D. D. Eisenhower's 1955 Atoms for Peace program. It now seems that it is up to these men and their colleagues to carry on with breeder reactor development.

This reviewer found few typographical errors. The format, printing, and figures are of excellent quality. This book is recommended for any reader who is interested in the history of the early days of nuclear power and the eventful story of a bold reactor project from beginning to end.

Lloyd R. Zumwalt is professor emeritus of nuclear engineering at North Carolina State University. His nuclear career began with the Manhattan Project in 1942. He was in pioneering work on the application of radioisotopes to industry and was associated with high-temperature gas reactor research and development for many years. Dr. Zumwalt's activities with the American Nuclear Society include having been a member of the Board of Directors and a founding member of both the San Diego and Eastern Carolina local chapters. His current interests are nuclear fuels and cycles, irradiation effects, nuclear waste disposal, and environmental effects of various energy sources.

Kinetics of Ion-Molecule Reactions

Editor	Pierre Ausloos
Publisher	Plenum Publishing Corporation (1979)
Pages	508
Price	$49.50
Reviewer	R. J. Woods

Studies of the kinetics of reactions between ions and electrically neutral molecules are relatively recent, although the reactions themselves have been known for over 60 years and have been recognized as important steps in organic reaction mechanisms in the liquid phase for almost as long. Ion-molecule reactions also play an important part in atmospheric and interstellar chemistry, radiation chemistry, the chemistry of discharges and gas lasers, and in combustion and, in the gas phase, have recently come under intensive investigation by a variety of sophisticated techniques. The present volume represents the proceedings of a North Atlantic Treaty Organization (NATO) Advanced Study Institute on the Kinetics of Ion-Molecule Reactions held at La Baule, France, September 4-15, 1978. An indication of the rate of advance in this area can be gained from the fact that this is the second NATO Advanced Study Institute on ion-molecule reactions in the space of four years.

The 22 papers and panel discussions included cover a wide range of topics concerned with the kinetics of ionic processes in the gas phase. Theoretical papers deal with quantum chemical computational techniques for the potential energy surfaces of ion-molecule reactions, the calculation of ion-permanent dipole capture rate constants, factors influencing thermal ion-molecule rate constants and collision processes, and the thermochemistry of polyatomic ions. New experimental techniques are reviewed in the final chapter while individual chapters deal with molecular beam studies and drift tube experiments. Experimental data are reviewed in the areas of ion-molecule collision complexes, charge transfers at thermal energies, internal energy partitioning, and the photodissociation of ions. Separate chapters cover ion-molecule reactions in low-temperature plasmas and their role in the formation of interstellar species and reactions in the atmosphere, in flames, and in lasers.

Of particular interest to physical organic chemists are chapters dealing with the reactions and properties of polyatomic, organic ions in the gas phase. These can be compared with the extensively studied and very much more familiar reactions of organic ions in liquid organic media

and in solution, and represent an important extension of the study of organic reaction mechanisms. In these chapters, thermodynamic data for both positive and negative polyatomic ions are presented and the gas-phase ion-molecule reactions of organic ions are classified on the basis of their mechanism. Stereochemical, steric, and acid-base (proton-transfer) phenomena are described and related to the corresponding phenomena observed in the liquid phase, where solvation of the ions is a significant factor. Ion-cluster formation in the gas phase, which relates to the transition between gas-phase and liquid-phase behavior, is the subject of a separate chapter.

This book will obviously be of most immediate value to those directly concerned with the kinetics of ion-molecule reactions, but it will certainly be of great interest to physical organic chemists and a very useful addition to the libraries of those working in the other areas where ion-molecule reactions play an important role.

Robert J. Woods is a professor of chemistry with the Department of Chemistry and Chemical Engineering, University of Saskatchewan, Canada. His current research interests relate to the radiation chemistry and photochemistry of coordination compounds of transition-metal ions and organic ligands, although at the present time he is on sabbatical leave with the Mines Pollution Control Branch of Saskatchewan Environment, working on problems associated with the uranium mining industry in Saskatchewan.

Boiling Phenomena

Editors	Sjoerd van Stralen and Robert Cole
Publisher	Hemisphere Publishing Corporation (1979)
Pages	945 (2 volumes)
Price	$85.00 for 2 volumes
Reviewer	Robert S. Wick

This two-volume collection is primarily addressed to the researcher in boiling phenomena as contrasted to an earlier volume published in 1978 by the same publisher, *Two-Phase Flows and Heat Transfer with Application to Nuclear Reactor Design Problems*, J. J. Genoux, Ed. Consequently, it will be of interest to a much wider audience than nuclear engineers. For example, there is considerable discussion of binary and ternary systems, pool boiling, and even electrolysis. The book, a collection of papers by 17 contributors, is very logically organized into 13 sections with considerable emphasis on basic phenomena as contrasted to design, this being the stated objective of the editors.

The main topics are nucleation, film and nucleate boiling, bubble growth, heat transfer, electrolysis, and thermodynamics. The contributors to the various sections include a cross section of European experts. The editors each have major contributions worthy of separate note. Van Stralen, after a general well-illustrated survey of boiling phenomena, has two contributions to heat transfer to boiling of pure liquids, and to binary and ternary systems. These are followed by separate detailed papers on detailed discussions of the topics of bubble growth, geometrical considerations, boiling at liquid-liquid interfaces, and even some of the problems associated with skim milk and cryogens. These bubble growth contributions take over 100 pages. Cole's contribution includes a further survey on nucleate boiling as well as an extensive series of review articles on nucleation phenomena. Certainly, these papers by the editors represent a major contribution to the total collection.

One of the attractive features of this collection is the way the reader can selectively go from the simpler aspects (if indeed these exist) of the subject to the more complex, each treated separately with a reasonably up-to-date collection of references. While the book probably would not be suitable as a textbook, the reviewer could envision graduate-level students being assigned one of the special topic papers for review and perhaps presentation at a seminar. The surveys by the editors, mentioned above, would make excellent supplemental reading for a course and could be considered as the nucleus for a course in boiling phenomena. Certainly, the book would represent an excellent place to start surveying the current research in the areas mentioned above. This work certainly deserves a place on the researcher's bookshelf and in the reference library of the educational institution.

Robert S. Wick (BS, mechanical engineering, Rensselaer Polytechnic Institute, 1946; MS, Stevens Institute of Technology, 1948; PhD, mechanical engineering, University of Illinois, Urbana, 1952) has been professor of nuclear and aerospace engineering at Texas A&M University since 1966. Before that he was at the Westinghouse Bettis Atomic Power Laboratories (starting in 1955), where he was associated with various reactor design projects.