

PREFACE

Exceptional strides are now being made in radiation chemistry although growth has been gradual. This long induction period dates back to the discovery of radioactivity and the development of x-ray tubes. Radium salts, the first radiation sources, were supplanted in the third and fourth decades of this century by x-rays. During this period, pioneering scientists such as Fricke, Lind, Mundt, Risse, and their collaborators laid the foundations of radiation-induced gaseous and aqueous reactions. From these modest beginnings research in this field gradually gathered momentum in the fifth decade by the use of Van de Graaff and cyclotron accelerators and in the sixth through the availability of powerful ^{60}Co γ -ray sources. Finally in the seventh decade the results of basic research exploded into prominence through the use of electron pulse accelerators. In this decade, we are reaping the benefits of these new developments by drawing attention to the applications of radiation chemistry. Since the 1930s the number of active workers in this field has multiplied a hundred-fold, and research has expanded from a few universities and national laboratories to research centers the world over.

The early workers established phenomena connected with the qualitative, and later with the quantitative changes taking place during irradiation. Products and some intermediate species were identified in gases and in aqueous solutions, and work progressed in three areas: dosimetry, radical and ionic yields, and relative rate constants. From these results, speculations regarding the mechanism of energy loss, of free radical and ion pair formation and distribution, were mathematically formulated and tested by the developing specialty of diffusion kinetics.

More recently, assisted by photochemistry, spectroscopy in its varied forms, chromatography, computers, and applied electronics, radiation chemistry is assaulting many of the problems associated with the properties of transient species at an unprecedented rate. Commonplace, already, is the study of intermediates lasting only milli- and micro-seconds. A rapidly developing subdivision is on the horizon—that of nanosecond and picosecond chemistry. Knowledge of the nature and rates of these reactions has been of inestimable aid in untangling reaction mechanisms in chemistry and biology. For example, the discovery of the hydrated electron and the determination of its rate constants has aided the interpretation of reactions in aqueous media. Recent studies on solvated and

trapped electrons in liquids and solids assist materially in explaining phenomena in these media. Similarly, the identification of singlet and triplet states in the radiolysis of gases and organic liquids provides data crucial for understanding these complex systems.

The papers reported in these two volumes constitute about two-thirds of those presented at the Argonne National Laboratory-sponsored International Conference on Radiation Chemistry, to which 200 prominent scientists and students from 21 countries and 81 universities and institutes were invited. This conference was in celebration of Argonne National Laboratory's participation in a decade of pulse radiolysis. All phases of radiation chemistry, from the theoretical to the fundamental changes taking place in complex molecules, were included. A special session on dosimetry was planned for Dr. Hugo Fricke on August 15, his 76th birthday, to honor him for his many contributions to radiation chemistry over the past 40 years. The conference papers are assembled in these two volumes: one, largely on aqueous solutions, consists of the survey and original papers given in the aqueous, biological, and dosimetry sessions; the other, largely organic, deals with similar groups of papers on gases, liquids, and solids. The broad scope and interest in these papers reflects the influence and applications of radiation chemistry in most branches of chemistry today.

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