PREFACE: SYMPOSIUM ON RADIATION CHEMICAL PROCESSING

GEORGE H. MILEY *Nuclear Engineering Program*
University of Illinois, Urbana, Illinois 61801

Symposium Chairman

Received February 3, 1969

The following nine papers were originally presented at an American Chemical Society symposium on "Radiation Chemical Processing" in September 1968. Much of the credit for the success of the symposium is due to members and officers of the Division of Nuclear Chemistry and Technology which served as sponsor. Special thanks are due to W. Wayne Meinke, Chairman of the division, for his constant help and encouragement and also to Joseph J. Martin who was instrumental in planning the symposium.

The outlook for widespread uses of radiation chemical processing has changed drastically over the years. In the early 1950's it was thought that anything treated with radiation would undergo a miraculous and useful change. Breakthroughs in uses for the anticipated mounting stockpiles of waste fission products from nuclear reactors were eagerly anticipated but, as we know, did not develop. In fact, neither did the waste product stockpiles. The prospect for radiation chemical processing was clearly "oversold." As this became apparent, optimism turned to pessimism, and research and research funds diminished.

Thus during the early 1960's, only a hard core of dedicated researchers was left. (I can make this statement with all honesty since during this period I, too, was working in "greener fields.") Results did not come easily, but we are starting to reap the harvest of this work. Pilot and large scale plants are now beginning to appear in several industries across the country. In addition, chemonuclear reactors appear to offer some interesting possibilities for water polution treatment, and large chemonuclear-agricultural complexes have been suggested as an important step towards the solution of problems in underdeveloped countries, such as India. However, despite these developments it is apparent from informal discussions at the ACS symposium that the area has not yet overcome its popular image as an interesting academic subject of little practical importance.

This situation is not unique. In fact, the nuclear power industry underwent a similar metamorphosis. Construction of nuclear power plants lagged far behind estimates prior to 1967. Then President Johnson announced a "breakthrough": nuclear generated power was competitive! New plants are now backordered through 1975, and few question the projected rapid growth of a nuclear-based power industry.

The cause of this dramatic change in the fortunes of the nuclear industry in 1967 cannot be traced to a specific technical advance. In fact, I submit that it was actually a psychological breakthrough in the sense that a broad awareness developed that, as a result of decades of research and development, nuclear power was now economically competitive.

There are indications that radiation processing is nearing a similar psychological breakthrough. At least the proper ingredients are now present. As noted above, new processes and improved techniques are gradually coming forth. The growth of nuclear power means that the waste product stockpile is finally going to develop. Last, but not least, the economic advantages and feasibility of large scale nuclear complexes are better understood today.

One indication that change is occuring is the noticeable increase in meetings and symposia, such as the present one, devoted to various aspects of radiation chemical processing. This symposium was not intended to be all-inclusive, but rather to sample developments in selected topics. The paper by Meyer Steinberg provides an interesting introductory review of the current status of radiation processing and chemonuclear reactors. Subsequent papers by Miley and Thiess,

by Haskin and Faw, and by Martin et al. deal with the analysis of radiation absorption in the chemical stream and the ensuing reaction kinetics. A speculative study of the possibility of using coherent laser radiation for the initiation of chemical reactions is presented by J. F. Verdieck; while this may not help use of the fission product stockpile, it does provide an interesting perspective to the area.

The papers by Gurley and Wethington, and by Liuti et al. consider specific systems, namely, fluorocarbon decomposition and nitrogen fixation. The fluorocarbon system has not received wide attention prior to this. On the other hand radiation-induced nitrogen fixation has received considerable study, and this paper reports recent results obtained by the authors who have been involved in the area since its inception.

New process techniques are presented in the papers by Wilkinson and Clifford and by Reyes et al. The processes described offer some intriguing advantages, but at the same time the papers raise questions that suggest that continued studies are required before a complete understanding can be claimed.