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Introduction

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INTRODUCTION

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It is my pleasure to open the International Colloquium on Synthetic Polymer Chemistry at the University of Massachusetts in Amherst. This Colloquium is under the sponsorship of the Polymer Science and Engineering Program of the University of Massachusetts.

My first order of business is to welcome you to Amherst, the 71 participants and guests of the Colloquium from the U. S. and from abroad. Half of the scientists came from abroad, representing 18 different countries from East and West, from North and South. I do not plan to mention anyone specifically. I will, however, point out that we have three past presidents of the American Chemical Society in the audience; the three past presidents whose scientific interest was in the field of organic polymer chemistry. I am particularly pleased that Professor Marvel, whom many people call the dean of synthetic polymer chemistry, was able to attend our Colloquium.

I do not have to tell you that much work had to be done for the preparation of this meeting. We were fortunate that Professor Lenz, vice chairman, and I had a number of dedicated and interested graduate students who did most of the work to

organize this meeting and assure its smooth operation. Mr. D. Alberghini was responsible for the arrangements and acted as the skillful coordinator. Mr. R. Ulrich took charge of publicity for the Colloquium and the publication of the proceedings. Mr. H. Chang was responsible for the organization of the lecture room. Last, but not least, I want to thank our industrial friends who have generously contributed financial assistance which made it possible to organize this Colloquium.

Let me say a few words about the conception of this Colloquium. About a year ago, it occurred to us that the Congress of the International Union for Pure and Applied Chemistry was being held this year in Boston, not far from Amherst, until Friday, July 28. In addition, the emphasis of this IUPAC Congress was on Organic Chemistry and included the Macromolecular Symposium on Synthetic Polymer Chemistry. The Gordon Conference on Polymers, an important conference for polymer chemists, was to begin on Sunday, July 30. This was a unique opportunity to bring together, for a Colloquium at the University of Massachusetts, Amherst, most of the active scientists working in synthetic polymer chemistry.

Both the IUPAC Symposium and the Gordon Conference on Polymers have an established meeting format. The IUPAC Symposium for Macromolecular Chemistry consists of formal presentations of research results and invited symposia, and the Gordon Conferences are informal discussions of recent research results suitable for an audience whose representatives are broadly interested in Polymer Science.

When we decided to hold this International Colloquium on Synthetic Polymer Chemistry, we decided that a working session of international authorities was desirable where they could discuss the problems of their respective fields, the unsolved problems, and try to develop in informal discussions future trends and possible directions of scientific ideas. It was also hoped that discrepancies or disagreements among scientists, especially where semantics and slightly different points of view were involved, could be resolved.

In our Colloquium, we did not want to have formal presentations of completed research efforts, as in the IUPAC Symposium, or progress reports of new incomplete research programs to a selected but broad audience of polymer scientists, as in the Gordon Conferences. We wanted to have an international group of scientists discuss selected problems of synthetic polymer chemistry, to clarify their sometimes differing points of view and to try to define problems of the future.

It was decided to use the format of panel discussions to provide the atmosphere for challenging discussions.

The purpose of this meeting is to relate research results, to try to find similarities between apparently different and unrelated work, to clarify uncertainties, to agree on common scientific expressions.

As subjects of discussion, it was decided to cover two areas of synthetic polymer chemistry which are experiencing new interest and growth: Radical Polymerization and Cationic Polymerization.

We have today, as participants of this Colloquium, a great number of active contributors to these two research areas and hope our efforts will have the desired results. It is also hoped that this Colloquium will be a stimulus to bring together periodically these scientists and others entering these fields on an international basis.

Radical polymerization plays an important role in synthetic polymer chemistry, in chain growth bond opening polymerization, and in polymer grafting. Many commercial polymerization processes are based on radical polymerization. Several years ago, we accepted radical polymerization as a branch of synthetic polymer chemistry that was well established, a technique that produced polymers in large quantities, with predictable stereochemistry and molecular weight distribution that gave copolymers, predictable by the Q, e scheme.

Then, recent reports from several laboratories appeared quite independently which described new phenomena in radical polymerization, particularly the "complexing" of monomers during polymerization. You will note that I left the word "free" out when I spoke of radical polymerization, rather than "free radical" polymerization, in order to emphasize that questions have arisen as to how free these radicals actually are. These reports have suggested that it is possible to change the rate of polymerization of monomers, normally considered "old monomers" for radical polymerization, to change molecular weight, or more importantly molecular weight distribution, or to change the stereochemistry of these polymers and to improve the thermal stability of the polymers by proper termination.

In copolymerization, the possibility of preparing simply and rapidly alternating copolymers, a highly desirable large group of polymers was hereto only obtainable in exceptional cases. Indeed, if some of these new phenomena should turn out to be valid observations, a modification of our general thinking about radical polymerization and copolymerization might be necessary.

Cationic polymerization, both bond opening and ring opening chain growth polymerization, has also had a recent renaissance. It was the work on cocatalysis in the early 1950's in England that created much interest in cationic polymerization. Recently published research results from several laboratories introduced new ideas into the field of cationic polymerization: radiation induced polymerization in the crystalline state and the requirement of rigorous purification to eliminate ionic impurities, isomerization polymerization, particularly the low temperature hydride migration polymerization; and the demonstration of living polymers in homo- and copolymerizations.

Another purpose of having this Colloquium arranged in this form is to bring together scientists from slightly different disciplines. Normally, scientists interested in cationic polymerization via carbenium ions, or those interested in polymerizations via ring opening or oxonium ion polymerization or radiation induced cationic polymer ion meet with each other and find they have much common interest within the group, but rarely communicate with neighboring disciplines. We asked representative scientists of each

group to join us for the discussion of the whole field of cationic polymerization. We also added a typical organic chemist interested in carbenium ion reactions to contribute to these discussions.

We would like to hear from you speakers, panelists and participants what you think the scientific problems in radical and cationic polymerizations are, and what we might expect in the future. Scientific discoveries cannot be made on command and we do not know what discoveries and inventions the future will bring, but we do know in which areas of synthetic polymer chemistry these are most likely to occur.

It is now my pleasure to introduce the people on the head table: Professor Roger Porter, Head, Polymer Science and Engineering Program, University of Massachusetts; Professor Mortimer Appley, Dean of the Graduate School, University of Massachusetts; Professor Charles Overberger, Chairman of the Chemistry Department, University of Michigan, past president of the A.C.S. and recently elected Vice President of the Division of Macromolecular Chemistry of the International Union for Pure and Applied Chemistry; Professor George Smets, University of Louvain, Belgium, the Secretary of the IUPAC Division of Macromolecular Chemistry; Dr. William E. Gibbs, Chairman of the Division of Polymer Chemistry; Dr. Jack Elliott, Secretary of the A.C.S. Secretariate for Macromolecules; and Professor Robert Lenz, University of Massachusetts, the Vice Chairman of our Colloquium, who did much for the conception and organization of the Colloquium.

It is now my privilege to introduce Professor Mortimer Appley, the Dean of the Graduate School, who will formally greet you on behalf of the University and tell you about Polymer Science and Engineering and the University of Massachusetts.