Preface

During the past half century, we have witnessed a proliferation of synthetic polymers with few parallels in the records of technological advance. Some of them have replaced polymers of natural origin used for the artifacts of man from time immemorial; notable examples are synthetic fibers and synthetic rubbers. Others have found new uses and applications made possible by their novel properties—applications which sometimes were comprehended only after creation of the unique polymeric material.

The uses of polymers have grown to the point where the total volume of these materials produced for the consuming public exceeds the combined volume for all metals. According to some projections, before the passage of many years polymers may even surpass metals in the weight produced per annum. Synthetic fibers which match steel in strength, and with about one-sixth the density, have reached commercialization in this decade. And the end is not in sight. Future generations, with benefit of the perspective of history, conceivably may designate the present and coming era as the age of macromolecules or polymers, just as we refer to the stone, bronze, and iron ages of the past.

A science of macromolecules has emerged more or less concurrently with these spectacular technological achievements. The importance of this branch of science is patent. Yet polymer science in general has lagged behind rather than led technology. It is only within the past five years, for example, that knowledge of the solid state in polymeric substances is at last finding firm foundations. Dissonant views in this primary area persist, and the confusion that has reigned for two decades may not immediately be dispelled. The current growth of interest in the science of macromolecular substances may lead to clarification of concepts useful in cultivating a deeper understanding of these materials, which are encountered on every hand, from living organisms to the products of industrial technology.

At first glance, one might suppose the data processing and electronics industries to be removed from polymer science. However, technological advances utilizing polymers in such diverse applications as lithography, storage and display technologies, microelectronic packaging, and passivation afford ample evidence to the contrary. IBM, with its broad interests and activities, has not been isolated from this major trend of the times. Indeed, its involvement with polymers is already widespread. The papers in this issue are indicative of the range of current concerns with polymeric materials in IBM.

What of the future? Prediction of coming events is invariably precarious. It is especially so in science and technology. Nevertheless, I venture the opinion that polymers for specialized, sophisticated applications, rather than polymers that can be produced cheaply in large volume, will assume greater prominence in the years ahead. Polymers specially designed for the intricate requirements of microcircuitry are illustrative. Other examples may include polymers with exceptional optical, electrical, or magnetic properties. Looking further into the future, one may ponder the possibility of synthesizing polymers that may be used to encode information at the molecular level, a feat already performed by nature in the DNA chains which encode genetic information in living cells. Less dramatic perhaps, but certain to be important, are the new polymers already on the horizon, which will have superior mechanical properties rendering them uniquely suited for the most demanding requirements, including those of business machines of the future.

One prediction can be made with greater certainty than any other: Materials and applications beyond our power of clairvoyance will turn out to be more important than anything we can foresee at present.

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