Nonlinear Optical Properties of Polymers

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Nonlinear Optical Properties of Polymers

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Preface

This volume represents the Proceedings of a Symposium on Nonlinear Optical Properties of Polymers held at the Fall Meeting of the Materials Research Society, November 30-December 5, 1987. Conjugated (π-electron) polymers have recently emerged as a class of materials with large nonlinear optical coefficients and subpicosecond response time. Although these features have established this class of materials as having potential use in a variety of future technological applications, an understanding of the mechanisms responsible for the nonlinear response is necessary before the design and synthesis flexibility afforded by organic chemistry can be applied to the development of new and better materials. The Symposium was, therefore, intended to examine the nonlinear optical properties of polymers (and other organic materials) and to seek an understanding of the fundamental mechanisms.

The Symposium was interdisciplinary (with a spectrum ranging from synthesis to measurement techniques to sophisticated theory), international (with contributions from six countries) and contained contributions from industry, government laboratories and academia. Both second-order nonlinear susceptibilities (e.g., for second harmonic generation) and third order nonlinear susceptibilities (i.e., for optical switches, transient gratings, third harmonic generation, etc) were considered. After an initial session focusing on device requirements, the remaining sessions addressed fundamental issues.

The recent progress in the area of conjugated polymers provided the core of interest at the symposium. In the area of $\chi^{(3)}$ processes, the principal mechanisms considered involved π-π^* (interband) transitions, excitons and nonlinear excitations such as solitons and polarons. In each case, a theoretical basis has been developed which indicates a mechanism for nonlinear optical response. Evidence was presented during the Symposium indicating that all of these represent important mechanisms.

The opportunities for new materials was a focus of the Symposium. Considerable progress was reported with promise for achieving highly oriented optical quality films through materials fabrication and polymer processing. Future synthesis of new materials will be guided by the progress toward identification of the mechanisms for nonlinear optical response reported at the Symposium and recorded in these Proceedings.

As the Symposium co-chairmen, we are grateful to all the participants at the Symposium for making it an exciting and meaningful event. In addition, we want to especially thank those who took the time to prepare a written manuscript for these Proceedings. Although we realize that this was a considerable effort, the written Proceedings will serve as an important record of the Symposium and of the status of Nonlinear Optical Properties of Polymers at the time of the Symposium. We thank the officers and staff of the Materials Research Society for assistance in preparing the Symposium, for assistance during the Symposium and for help and guidance in the preparation of this volume. Finally, we are grateful to Joan Jacobs for compiling, indexing, etc., etc. this volume. Without her help, the job would not have been completed.

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