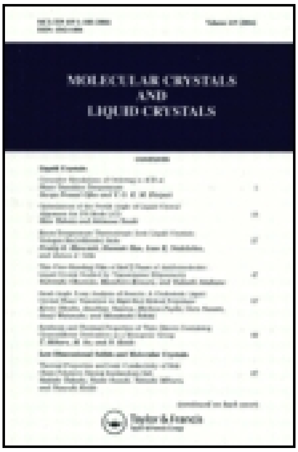

Molecular Crystals and Liquid Crystals Incorporating Nonlinear Optics
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Preface

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PREFACE

The Brookhaven Symposium clearly demonstrated how electroresponsive polymers have become one of the most expansive and dynamic fields of science in recent years. Few other areas span to such an extent the whole spectrum of scientific endeavor from synthetic organic chemistry to theoretical physics.

The intent of this conference, which gave it its unique flavor, was to bring together the leading researchers representing the various subfields of electroresponsive polymers, including electronically conducting polymers, ionically conducting polymers, redox polymers, piezo- and pyroelectric polymers, and nonlinear optical systems.

Some significant developments have taken place since the first symposium in 1985, including the synthesis of a more oriented, defect-free and highly conducting form of polyacetylene by H. Naarmann at the BASF laboratories, as well as major advances in producing processable and stable conjugated polymers.

The Langmuir-Blodgett technique is emerging as a central materials fabrication method for producing ordered, anisotropic structures, especially for nonlinear optical applications. Nonlinear optics is clearly emerging as a promising application area for electroresponsive polymeric systems.

The spectacular results on Naarmann-polyacetylene have raised new questions about the basic conduction mechanisms in conjugated polymers. Intriguing suggestions have been made about the possibility of achieving high temperature superconductivity in polyacetylene, with a mechanism analogous to that described by the resonating valence bond theory of the copper oxide superconductors. Experimental evidence for fundamental similarities between the two classes of materials comes from infrared experiments on La_2CuO_4.

The ion conducting polymers represent a separate class of materials and have shown promise as thin film solid electrolytes in a number of electrochemical devices, in particular high energy density rechargeable lithium batteries. The systems are liquid-like and high ionic conductivity is associated with disordered, non-crystalline structures and low glass transition temperatures. The battery technology which has been developed, incorporates poly(ethylene oxide) based electrolytes which have the requisite conductivity at elevated temperatures, 80–100°C.

Siloxane-based polymers represent an important advance in the development of polymeric solid electrolytes which can operate at room temperature. An enhancement in room temperature conductivity of two to three orders of magnitude over poly(ethylene oxide) based materials combined with excellent mechanical properties have been achieved with these systems. This opens the possibility for room temperature applications as well.

The extraordinary variety of structures, properties and possible applications of electroresponsive polymeric systems is also illustrated by work on catalytic properties of chemically modified electrodes; organic and organometallic ferromagnetic systems; and binding and timed release of drugs from polymer electrodes.

The field of electroresponsive polymers has clearly matured, and the major hurdles against producing commercially useful materials have fallen much faster than most people in the field would have thought possible only two years ago. By bringing researchers from the various subfields of electroresponsive polymer science together, the Brookhaven Symposium may have provided some cross fertilization to open yet new areas of research in this highly dynamic field.

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