

should be seen as essential reading for researchers coming new to the field of microlithography.

The opening section on 'Fundamentals in Radiation Chemistry of Polymers' contains five papers which take the reader from the discovery of X-rays and radioactivity in 1895 to present day attempts at understanding the reactions occurring during the radiolysis or photolysis of polymers. The section on 'Resist Materials for Electron and X-Ray Lithography' addresses issues concerned with the design of new resist materials or processes, and contains many impressive SEM micrographs of patterns developed from novel resist materials. New resist materials and processing considerations in optical lithography are covered in the third section of the book, and the potential of multi-level resist processing is clearly demonstrated in the section on the 'Etch Resistance of Polymers in Plasma Environments'.

Given the considerable and growing importance of photonics, particularly for technologies related to communication and information handling, it is appropriate that five papers discuss the properties of polymers in this context. The use of polymers as dielectrics can be traced back to Bakelite, but more recently inorganic materials have been mainly used in microelectronic devices. However, polyimides are growing in their use and importance, and a further six papers give the reader an insight into the type of research being carried out in the search for high temperature polymers for electronics applications. Polymers used in the packing and interconnection of microelectronic devices are given due attention, reflecting the concern of industry to maintain a high level of performance in such operations. In the final section of the book the topic switches to 'Conducting Polymers', Four papers illustrate the breadth of research in this field which ranges from the synthesis of new conducting polymers to calculations of electronic band structures, which can be used to assess the potential of particular polymers as electrical semiconductors.

Although all papers have been produced by the authors for direct reproduction, rather than being typeset by the publisher, the quality of the print,

diagrams and figures is generally high. This book is a must for polymer scientists, both academic and industrial, who wish to keep abreast of research into applications of polymers in electronics and photonics.

G. C. Corfield  
(Humberside College of Higher  
Education)

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## Developments in Oriented Polymers—2

I. M. Ward (Ed.)  
Elsevier Applied Science, Barking,  
1987, X+279 pages, £42.00  
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This second volume in the series of developments in oriented polymers provides a good account of both theoretical and practical aspects of oriented polymers. The book consists of seven well-written chapters.

Chapter 1 by Young opens with an introduction on the subject of polymer single crystal fibres followed by sections on solid state polymerization, structure, elastic deformation, plastic deformation and fracture behaviour of single crystal polydiacetylene fibres. Properties of polydiacetylene/epoxy composite systems are also discussed.

In the second chapter, on high-strength/high modulus structures based on flexible macromolecules, Lemstra *et al.* review the development of various techniques and processes to produce high-strength/high-modulus polyethylene structures. The article consists of six sections. The first section is a general introduction to the subject followed by sections on solution-spinning of linear polyethylene, basic aspects of ultra-drawing, some properties of high-performance polyethylene fibres and gel-spinning of other flexible polymers.

Spinning from lyotropic and thermotropic liquid crystalline systems is the subject of a chapter by Ciferri. In his

article, the author reviews recent results on mesophase formation, and includes a discussion on spinning data for four classes of polymer. These polymers have been the basis of studies on lyotropic and thermotropic systems and include chains with rigid conformations such as poly(*p*-benzamide), poly(*p*-phenylene terephthalamide); chains with semi-rigid conformation, e.g. polyterephthalamide of *p*-aminobenzhydride, cellulose and polyesters containing flexible methylene units.

In Chapter 4 Dobb and Johnson present studies of the structures of fibres obtained from lyotropic liquid crystals and mesophase pitch. The authors describe the development and structure/property relationships of poly(*p*-phenylene terephthalamide) fibres obtained via a lyotropic mesophase and carbon fibres derived from thermotropic mesophase pitch.

Structure and properties of thermotropic liquid crystalline copolyesters are discussed by Blackwell and Biswas in Chapter 5. There are good sections on synthesis, characterization and properties of main-chain liquid crystalline polyesters.

Chapter 6 by Monnerie deals exclusively with infra-red dichroism and fluorescence polarization. The experimental results are compared with theoretical predictions of molecular viscoelasticity in polymer melts.

In the final chapter, relating to oriented polyamides, Owen discusses relationships between structure and thermomechanical properties of oriented polyamide. Section 2 of this chapter deals with crystallographic and morphological structure of oriented nylons and this is followed by a section on their orientation behaviour. Thermomechanical properties are reviewed in section 4 and the last section deals with the structure and properties of aramid fibres.

As a whole the book is well produced and provides an up-to-date account of the state of the art and will be of interest to polymer and materials research workers, particularly those interested in the science and technology of oriented polymers.

T. H. Shah  
(University of Manchester Institute  
of Science and Technology)