

anisometry, conformational changes (e.g. helix-coil) may be followed by electrical-optical rotation whilst electric field light scattering measurements enable calculation of dipole moments and rotatory relaxation times. All these subjects and others are dealt with in this book.

The contents of the book are the main lectures given at Rensselaer Polytechnic during a NATO Advance and Study Institute held in July 1980. There are twenty two separate contributions and between them they cover the whole subject range of physico-chemical electro-optic studies. Thorough discussions of Kerr effects (O'Konski, Jernigan and Miyazawa) and electric field light scattering (Jennings) are naturally present, accompanied by discussion of polarized fluorescence (Weill) and electric birefringence dynamics (Krause and O'Konski). Notwithstanding the title, the fundamental electro-optic theory of small molecules is surveyed in Buckingham, whilst a particularly interesting chapter on liquid crystals is authored by Dunmur.

Apart from these detailed reviews, several chapters deal with specific materials, e.g. proteins, polynucleotides, viruses, whilst Mandel provides a clear, up to date and enjoyable discussion of polyelectrolytes. A particularly welcome feature for those about to undertake electro-optic studies is a critical evaluation of apparatus and the factors governing choice given by O'Konski and Housier.

The price of circa £30 is not unreasonable by today's standards for a specialist book, and is recommended to all involved in electro-optic investigations.

Additionally the information contained in it, together with the detailed references, given, make this book a survey of current electro-optical theory and should therefore be in all libraries. For a book of this size (500 pages) there are few printing errors although page 81 has a photograph reproduced back-to-front.

R. W. Richards

'Principles of Polymer Morphology'

D. C. Bassett

Cambridge University Press,
Hardback: £25, 251 pp.

This book is intended to serve as an introduction to the microstructure of semi-crystalline polymers for undergraduates, postgraduates and research workers in allied fields. In practice it gives a good background to the lamellar nature of polymer crystals, and to the organization of lamellae into larger structures such as spherulites. The examples and illustrations used are primarily of polyethylene, which perhaps reflects the fact that this is the polymer whose morphology has been studied in the greatest detail. More surprising perhaps is the emphasis placed on anabaric polyethylene (polyethylene crystallized at pressures in excess of 3Kbar).

The book is divided into nine chapters, at the end of each chapter one of two review articles are cited for those wishing to find out more about the subject. Apart from these review articles there are very few references given in the text, which tends to state what is known rather than who did what.

The first chapter deals with some of the fundamentals of polymer science, such as molecular and crystal structures and then describes briefly some of the more important techniques used in the study of the polymer morphology. The second chapter is concerned with the spherulites and their overall morphology; the theory of Keith and Padden proposed to account for the growth of spherulites is also outlined. In the third chapter the lamellar nature of polymers is properly introduced; particular emphasis is placed on the habits and sectorization of solution grown single crystals. The fourth chapter is concerned with the development of larger structures from lamellae. The various crystallographic forms which can arise are discussed before the development of three-dimensional structures is introduced. The latter part of the chapter is devoted to melt crystallization and the relation between lamellae and the spherulite texture.

The fifth chapter is concerned with the crystallization processes themselves, first it shows that crystallization occurs by a secondary nucleation process, then discusses fractionization and annealing and their effect on morphology. The sixth chapter is devoted to a brief description of the kinetic theory of crystallization as formulated by Hoffman and his coworkers. The derivations of the equations of both of the lamellar thickness, and of the growth rates are sketched. The seventh chapter is concerned with crystallization with chain extension, the bulk of this chapter deals with the structure and morphology of high pressure crystallized (anabaric) polyethylene. The achievement of chain extension in flowing systems is also briefly described. The eighth chapter deals with the relationship between the morphology and chemical behaviour; this includes a description of diffusion behaviour and of possible chemical reactions at fold surfaces. The effects of irradiation are also discussed. The final chapter deals very briefly with some aspects of mechanical behaviour as related to morphology.

Most aspects of polymer morphology are therefore dealt with in varying degrees of detail, reflecting the particular interests of the author. The book provides an introduction to polymer morphology, which is suitable for both post-graduate and undergraduate students, and new research workers, although at £25 it would be expensive as an undergraduate text-book.

P. J. Barham

Low Temperature Properties of Polymers

I. Perepech-o

Pergamon 1980.

In two monographs Professor Igor Perepecho has reviewed the high and low temperature properties of amorphous and crystalline polymers. The first monograph is entitled 'Acoustic Methods of Investigating Polymers' and is a comprehensive survey of the literature upto 1972, it is available from MIR and was published in 1975. The second monograph, which is the subject of this review, was published in 1978 in Russian by MIR and subsequently has been released by Pergamon in English translation in 1980. Despite the apparently recent date of publication (of the latter monograph) the literature coverage of both monographs is the same and as such the monograph on the low temperature properties of polymers is approximately eight years out of

date on publication in its English translation. Despite these severe limitations, this monograph does make a useful contribution to the literature providing as it does a comprehensive coverage of some of the earlier and more obscure Russian literature.

The reader unfamiliar with the low temperature properties of polymers will find this monograph a useful introduction to the subject. The monograph presents an interesting slant to the literature, in which some rather less familiar contributors to the theory have slightly more prominence than in the usual literature on this subject. The monograph starts with a traditional approach, developing the Debye and Lifshitz theories of heat capacities and then discusses the various particularizations introduced to describe molecular systems. The specific heat measurements of polymers using traditional methods is described, the more recent developments in this area are not considered. Likewise the subsequent chapters which are concerned with thermal conductivity, thermal expansion electrical properties, nuclear magnetic resonance, dynamic mechanical and acoustic properties and viscoelastic measurements are all concerned with the data obtained from the now more classical techniques. The newer pulsed laser techniques for the exploration of thermal properties are not mentioned, the various omissions only emphasize the progress which has been made in this subject since 1972. Each chapter contains an appropriate discussion of crystalline and amorphous polymers and includes consideration of polyethylene, polytetrafluorethylene, polymethylmethacrylate and nylon. In the section on ultrasonics there is a obvious overlap with the first monograph, however it is clear that the author has to a large extent seen these as companion volumes and the general overlap is relatively small. It would be easy to list the various inadequacies in the book, for example its lack of a discussion on orientated polymers with their large and important anisotropy in thermal properties. Similarly despite that fact that various fluorinated polymers are discussed there is no coherent comparison of the variation of the Van der Waals interactions on the low temperature heat capacities. These and various related topics have all been the subject of extensive studies during the period 1977 1980 and the reader is strongly recommended to supplement this monograph with consultation of papers and reviews published in *Polymer* and other journals in the last eight years.

As a teaching text rather than as a research monograph, the reader will find it well presented and the style of presentation is good for a Russian text. There are very few sections where the reader will feel aware that this is a translation, the most obvious being the occasional use of Russian characters, sometimes unexplained in the text in reference to the original diagrams. It is obvious that the original art work has not been 'translated'.

Despite the obvious criticisms of the monograph the text can be unreservedly recommended as an introductory text on the subject and since it covers obscure literature it makes a valuable contribution to the review literature on the subject. Professor Perepecho is to be congratulated for his effort and it would be pleasing to see an upto date monograph to complement these in the future.

R. A. Pethrick