

Book Review

**Treatise on Solid State Chemistry
Volume 3: Crystalline and Non-crystalline Solids.** Edited by
N. Bruce Hanney
Plenum Press, New York and
London, 1976 774 pp. £22.05.

This book is the third of a seven volume series where, to quote the general Foreword, 'the central theme is the exposition of unifying principles in the chemistry, physical chemistry and chemical physics of solids . . . intended for advanced workers in the field' and even a glance at the contents will indicate the significance of these remarks. One becomes aware of the extent of the topics covered (they range from metallic glasses to photo- and electro-conducting complexes) and at the same time the many principles, theories and experimental findings involved in these areas of materials engineering sciences.

Edited by a Vice-President of the Bell Laboratories, which organization is responsible for the copyright, the nine chapters are written by authorities from various industrial and university departments in the USA, and in some cases acknowledgement is made for support from US government sources. The chapters vary greatly in both length and specialized treatment, but each is written so as to provide a comprehensive survey of a subject and can be read, if wished, without reference to other parts of the book where, however, readers will find much of interest outside their own immediate fields of endeavour. There is a great deal for the polymer scientist for, apart from a treatment of many selected aspects of materials structure and behaviour, two chapters (which comprise more than one-third of the book) deal specifically with crystallization in polymers, and, since this review is being written for POLYMER, perhaps it would be well to mention these first.

Both are contributed by members of the Institute of Materials Research, National Bureau of Standards. Chapter 6 (161 pp., 309 refs) by Khoury and Passaglia is written for the non-specialist and discusses the morphology of crystalline (generally olefinic) polymers, covering the structural requirements for crystallinity to occur, crystallization from dilute solutions and resulting morphological forms, and crystallization from melts, with critical attention to developments over the years in crystallization procedures, optical and electron microscopy, single crystal and spherulite formation, and chain-extended growth and the influence of pressure, so that there is opportunity for the reader to obtain a reasonably detailed and up-to-date background on the subject. From the technological angle, it is perhaps a pity that the implications of orientation and crystal morphology in films and fibres and, to some extent, in mouldings, are not discussed.

Chapter 7 (117 pp., 191 refs) by

Hoffman, Davis and Lauritzen is more specialized, dealing with the rate of crystallization of linear polymers with chain folding and bringing in the thermodynamics of crystallization behaviour, crystal growth, lamellar formation, effect of temperature, and variations in chain folding and nucleation. As in the preceding chapter (with which a little, probably necessary, duplication occurs when general principles are discussed) there is an abundance of up-to-date references plus excellent diagrams and plates depicting crystal formation, morphology differences and experimental data. Few typographical errors were observed, although on p 515 the authors should give attention to the formula of polybutylisocyanate (and name it correctly on p 517), and set out more clearly the disposition of the polar groups in other formulae, as well as giving one for TMPS.

The first chapter of the book (Sinha, Giessen and Polk) on metastable phases produced by rapid quenching from vapour or liquid, deals essentially with the formation and nature of thin films of pure or mixed elemental composition resulting from evaporation, sputtering and electrodeposition processes, a critical survey of metallic crystals and glasses of some importance to the newer electronic technology and engineering.

The next chapter on inclusion compounds is by Gamble and Geballe, discussing a number of systems where there is an intruding species to be accommodated without gross effect on overall structure but with appreciable changes in electrical, optical or magnetic behaviour. This brings in consideration of metallic clathrates, boron compounds, graphitic and chalcogen intercalates, layered halides and tungsten bronzes, and indicates their value in molecular engineering. The chapter is followed very logically by Eyring and L-T. Lai with one on the structural chemistry of some complex oxides where a number of crystal defects giving rise to useful changes in reactivity, diffusion and electronic and optical properties are discussed, together with claims for the

advantages of electron diffraction in studying the specialised systems selected.

Chapter 4 by Bowman and Krikorian is based on work done for the US Atomic Energy Commission and discusses the crystallography of compounds containing interstitial phases with particular reference to packing in transition metal hydrides, carbides and nitrides and effects on thermal and electrical properties and hardness. Uhlmann of MIT follows this with the short chapter 5 where he deals with the formation and structure of some amorphous materials which are essentially inorganic oxides and ceramic glasses, some of commercial importance.

The two concluding chapters are directed especially to the electronic properties of organic solids. Kelper (chapter 8) contributes a specialised review on the molecular and crystal structure of anthracene, where he covers optical absorption, fluorescence, and electronic behaviour in the photo- and electro-conductivity of this compound, which can serve as a pattern for theoretical consideration of other related systems in solid state physics. With chapter 9 Soos and Klein review charge transfer complexes with particular reference to molecular array and crystal structure and introduce a quantum mechanical treatment of the subject. This chapter will appeal to workers who have interest in the conductivity of crystalline organic complexes based on π electron acceptors or donors.

Thus the book deals with the structure and behaviour of a wide spectrum of inorganic and organic solids and there is much of interest, either generally or on a particular topic. Not only is each section handled in a comprehensive manner, both practically and theoretically, but there is a wealth of data and references. The book is attractively produced with clear illustrations, diagrams and tables, and can be a useful and not necessarily expensive acquisition for libraries serving materials sciences and engineering and solid state chemistry and physics interests.

R.J.W. Reynolds

Conference announcement

Polymer Physics

Shrivenham, Wilts, 21–23 September 1977

The Polymer Physics Group will be holding its biennial conference at the Royal Military College of Science, Shrivenham, Wiltshire from 21 to 23 September 1977. The Biennial General Meeting of the Group will also be held at Shrivenham during the conference period. As in previous years, the aim of the conference is the reading of papers and general discussion on topics of current interest in the general field of polymer physics. Those interested in contributing papers are invited to submit a title and outline of about 300 words by 1 June 1977 to Dr J. V. Champion, Department of Physics, City of London Polytechnic, Jewry Street, London EC3N 2EY, UK.