book reviews

Inorganic Polymers

J. E. Mark, H. R. Allcock and R. West
Prentice Hall, USA,
1992, 272 pages, £59.50
ISBN 0-13-465881-7

Although it is one of a series of books devoted to polymer science and engineering planned or published by Prentice Hall, with J. E. Mark as the series editor, this slim, well-presented, clearly illustrated volume provides an excellent self-contained introduction to inorganic polymer chemistry appropriate for use by undergraduates or graduate students or indeed by specialists from other fields wanting to know what inorganic polymers are like, how to make them, and what are their present and potential future uses.

The book starts by explaining, in sixty very helpful introductory pages, what inorganic polymers are known and how they (indeed polymers in general) can be characterized. This introductory material, which will be particularly appreciated by newcomers to the field, is followed by detailed discussions of polyphosphazenes (80 pages), polysiloxanes (45 pages) and polysilanes (50 pages) that focus on the syntheses, structures, reactions, properties and applications of these three well-developed types of inorganic polymer, authoritatively conveying a real feeling not only for their nature and chemistry but also for the rich diversity of their uses, whether as high performance (e.g. thermally stable, oxidation-proof or hydrolytically resistant, biocompatible) polymers in their own right or as precursors through which to prepare other specialist materials.

Such known or prospective uses are also touched on in the final chapter (28 pages) that all too briefly surveys other types of inorganic polymer. Although the authors stress in their Preface that they have aimed to introduce the reader to the subject by suitably chosen examples rather than by attempting to be comprehensive, and deserve to be congratulated on their success in that respect, I personally would have preferred to see a rather fuller treatment of other systems in this final chapter which may lead the reader to believe that even less is known about other systems than is the case. The authors appear to have been content to use some rather condensed or occasionally dated sources of material for this particular chapter, and to have settled for a superficial treatment. In particular, I found the treatment of boron-containing polymers disappointing. Admittedly, the most exciting developments in this area such as Shore's tubular form of boron nitride have occurred since the book was written, but boron–nitrogen systems deserve more attention than they received here, and the considerable amount of work done on polymers incorporating carborane icosahedra over the past twenty-five years merits more than the few sentences given here. Polymeric sulfur nitride also deserves better treatment.

However, these are minor subjective carps that stem from the authors' decision to use polyphosphazenes, polysiloxanes and polysilanes as the vehicles by which to illustrate the rich variety of chemistry to be found in inorganic polymers. Within these chosen areas they have done a splendid job, conveying real insight and spicing their accounts with fascinating pieces of information, particularly about applications of these materials. Each chapter is furnished with a substantial list of references to accessible material, and the well-structured table of contents and sensible index provide rapid routes to specific material. This volume provides an excellent introduction to its subject and should help provide the stimulus needed to encourage more people to explore and exploit a class of compound that will become increasingly important in the future, whether in the development of new high-technology devices, in surface treatments, in high temperature materials or indeed in biomedical applications. It is a great pity that its price shows the publishers are looking for sales to libraries rather than to individuals.

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Inorganic Materials

Duncan W. Bruce and Dermot O'Hare (Eds)
John Wiley & Sons Ltd, Chichester,
1992, £55.00
ISBN 0 471 92889 5

'Inorganic Materials' is made up of nine articles, with thirteen authors in total. First and foremost it is a book written by chemists for chemists, although the interdisciplinary nature of modern research in Materials Chemistry is conveyed successfully.

Despite the all-embracing title, the book deals exclusively with molecular solids, with no discussion of the more traditional areas of Materials Research, i.e. Metallurgy and Ceramics. The common element of all the articles is the application of molecular inorganic chemistry to the development of novel materials.

The first three chapters deal with physical applications of molecular inorganic solids, covering superconductivity, magnetism and non-linear optics. Attention is focused on the superconductivity of $[M(dmit)_2]$ complexes (where M = Ni, Pt, Pd and $dmit^{2-}$ = 1,3-dithiol-2-thione-4,5-dithiolato), of which just four are known to be superconducting (under pressure). These materials are clearly overshadowed by organic superconductors, with no essential function for the metal centres identified as yet. The chapter on magnetic materials reviews binuclear compounds, consisting of two magnetic (metallic) centres, and magnetic chain compounds. Particular attention is paid to compounds with ferrimagnetic chains of alternating magnetic spin-orientations, and several strategies for designing molecular-based ferromagnets are critically discussed. The chapter on non-linear optics provides a readable account of non-linear molecular polarizabilities and second/third harmonic generation. This is followed by an interesting treatment of how a non-linear polarizability can be 'engineered' in metal complexes and metal-containing organic polymers. Apart from the overall requirement of a non-centrosymmetric crystal structure, it is maintained that a second order non-linear optic molecule should show both high linear polarizability and significant anharmonicity. Discussion of these attributes is conducted in terms of a model with contributions from the ground state of the molecule and a single charge-transfer excited state.

Of the remaining six articles, only one deals explicitly with polymeric coordination compounds, thereby being of particular interest to readers of this journal. In connection with electrically conductive materials, the formation of polymers made up of metallomacrocycles is discussed, focusing on the choice of metal atoms and bridging groups. Macrocycles such as porphyrins and phthalocyanines are considered, with both covalent and non-covalent (i.e. coordinative) bridging groups. Particular attention is paid to covalently linked silylphthalocyanines $[Si(Pc)O]_n$, encompassing electrical, magnetic and optical properties. In another chapter, concerning metal-containing liquid crystals, a good introduction to the phenom-

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