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BOOK REVIEWS

The Real Structure of High-T_c Superconductors. Edited by V. Sh. Shekhtman. *Springer Series in Materials Science, 23.* Springer-Verlag, 1993. Pp. × + 190. Price DM 138.00. ISBN 3-540-56559-0; 0-387-56559-0.

The understanding of the relationships between the structure and the physical properties of high-T_c superconductors, and ultimately their control, are critical to the successful application of these materials. This book aims to address aspects of this problem by considering the influence of the real (as opposed to the ideal) structures of high temperature superconductors on their physical properties. The term 'real' is used to stress the importance of disorder and defects in high-T_c phases and particular attention is focused on oxygen non-stoichiometry. The book contains a well-written, short introduction followed by seven review chapters written by members of the Institute of Solid State Physics of the Russian Academy of Sciences, Chernogolovka. The subject matter for the chapters clearly reflects the research interests of the Institute, although the literature surveyed in each provides a comprehensive review of worldwide research in the specific area. Topics covered include planar defects, deformation and microhardness properties, vortex structure in single crystals, magnetization processes, halogen-treated $YBa_2Cu_3O_7$ (Y-123) and Mössbauer spectroscopy of Y-123 and related phases.

Considering firstly more general features of the book, its title appears inappropriate since it fails to convey to the majority of readers a clear indication of the contents. Although I understand the logic behind avoiding the term 'defect structure', the term 'real structure' is not commonly used and will probably confuse many solid-state researchers. Moreover, the title suggests the major theme to be the structural chemistry of high-T_c materials, whereas the primary thrust of the book relates to properties, and more specifically how these are influenced by particular types of structural features. In fact, very little defect chemistry is included, and most relates to the Y–Ba–Cu–O system, which is very restrictive. Even for this system, the detailed ordering of the oxygen atoms in the basal layer to give superlattices is not considered, and it is amazing that the generally accepted influence of these structures on T_c does not warrant detailed discussion in such a book. The second main general failing is the very high number of typographical and other errors that remain in the final version. It is also unusual and slightly disturbing to encounter the symbol '÷' used to indicate ranges, *e.g.* 2 ÷ 3 μm.

After the introduction, two chapters provide a very good description of the role of electron microscopy and X-ray topography for detailed studies of planar defects, including twin boundaries, in high-T_c materials. This section also introduces the basic structural properties of Y-123 and Bi-2212 superconductors, but avoidable errors (*e.g.* the labelling on the Y-123 structural figure does not correspond with the text) render this of limited value. The mechanical properties of ceramic and single-crystal samples of Y-123 are then compared and the differences attributed to the effects of grain boundaries and oxygen content. Chapters on the magnetic properties describe vortex ordering and the anisotropic properties of single crystals and consider the important effects of twin boundaries and associated variations in oxygen composition. The following chapter on Y-123 treated in halogen vapours describes materials that have not been adequately characterized and, therefore, interpretation of their properties is necessarily contentious, which is acknowledged. This work is given too high a profile in the book and it is inappropriate to describe the early study of Y-123 fluorination by Ovshinsky *et al.* as pioneering. The final chapter is also very specialized and considers the implications of Mössbauer studies of Fe-doped Y-123. The extension of this section to include Fe-doped $Ba_4YCu_3O_x$ is largely irrelevant to the major theme of this book.

Overall, the book's readability is limited by the high number of errors that should have been eliminated by appropriate proof reading. Despite the fairly general title, the book actually is very narrow in content: it is too strongly biased towards the Y-123 system and very many important aspects of defect structures are not considered. The book will appeal only to research workers active in the areas selected for detailed coverage and the price is consistent with this place in the market.

C. Greaves

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Structure and Properties of Polymers. Edited by E. L. Thomas. *Materials Science and Technology, Volume 12.* Series editors, R. W. Cahn, P. Haasen and E. J. Kramer. VCH, Weinheim, 1993. Pp. xiv + 786. Price £160.00. ISBN 3-527-26825-1.

This volume addresses structure–property relationships by way of reviews of aspects of solid-state structures and properties by a number of authorities in the field. In a mainly physical context, chain connectivity and recognition of the conformational diversity characteristic of chains in their non-crystalline and semicrystalline states is seen to be the key to quantitative treatment of many properties. The interplay of entropy and energy in determining equilibrium states in polymeric systems is well represented, and provides a unifying theme.

Details of polymer characterization are dealt with elsewhere in the series (Volume 2), and this important aspect is restricted to a short introductory chapter (L. J. Fetters and E. L. Thomas) in which the role of tailored model polymers and copolymers in defining structure–property relationships is emphasized. The recommendation of rigorous characterization of polymers by absolute (static light scattering) as well as secondary (GPC) techniques is welcome. Further illustration of the potentially misleading representation of molar-mass distributions *via* GPC curves might have been useful.

Initially in the volume, attention is directed towards structural states (amorphous, crystalline, semicrystalline, liquid crystalline) of polymers and polymer blends, thus providing a substantial basis for the accounts of properties that follow. The amorphous state is described (F. T. Gentile and U. W. Suter) from the viewpoint of molecular (atomistic) modelling, and concentrates on the glassy state. Polymer single crystals (reviewed by B. Lotz and J-C. Wittmann) are described both for themselves, and for the contributions obtained from studies of these 'ideal' materials towards understanding the more complicated morphology of the semicrystalline state (P. J. Barham). The importance of chain folding in the nucleation and growth of polymer crystals is well illustrated. The liquid-crystalline state in polymers (reviewed by M. Ballauf) completes the survey of structures.

The review of polymer blends (by T. Hashimoto) concentrates on liquid–liquid phase separation of initially miscible systems and describes the evolution of structures following spinodal decomposition of unstable mixtures. Brief descriptions of the effects expected during spinodal decomposition of both crystallizable systems and block-copolymer systems are included. Structures determined by phase separation of

metastable mixtures (*i.e.* by nucleation and growth) are not discussed.

The reviews of properties include some relevant juxtapositions: *e.g.* the elastic properties of crystalline polymers (energy dominated, reviewed by D. T. Grubb) and rubbery polymers (entropy dominated, reviewed by the late R. Ullman); viscoelastic properties (M. Doi), plastic deformation (B. Crist) and dielectric properties (G. Williams); surface properties (M. Tirrell and E. E. Parsonage) and fracture/crazing (I. Narisawa and A. E. Yee). The survey of properties is completed by accounts of optical properties (W. Knoll) and high-performance fibres (H. Jing, W. W. Adams and R. K. Eby). The former includes descriptions of polymers in film and fibre configuration, and specifications for generation and application of non-linear effects; the latter reviews the methods of formation, structures and properties of fibres formed from liquid-crystalline and flexible polymers.

The standard of the reviews is uniformly high, and together they present a very favourable impression. All are clearly written and well presented with good reproduction of diagrams and photographs. Ample references are included with each review, together with suggestions for further reading. The level is somewhat beyond the introductory without being too specialized, making it suitable for materials/polymer scientists working in the field and particularly for research students with some course work in polymer science and technology behind them.

Restriction to a single volume means that its range is more limited than its 'comprehensive' label might suggest. Of recent compilations, it might be usefully compared with *Comprehensive Polymer Science, Volume 2* (Pergamon, Oxford, 1989), with which it has contributors in common and which is aimed at the same readership albeit within a more chemically-orientated series. One notices differences in coverage, notably of liquid-crystalline polymers, polymer solutions, adsorption of polymers at surfaces, permeation of small molecules, and ionic and electronic conduction in polymer systems. Moreover, the obvious overlaps are far from complete, *e.g.* there are interesting divergences between the reviews of the crystalline state in the two works. I am pleased to have both volumes on my bookshelf.

C. Booth

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Polymeric Delivery Systems: Properties and Applications. Edited by M. A. El-Nokaly, D. M. Piatt and B. A. Charpentier, *ACS Symposium Series 520* American Chemical Society, 1993. Pp. xii + 411. Price US$99.95. ISBN 0-8412-2624-5.

The idea of using polymers to control the delivery of active materials is not new but remains very active with applications in food and cosmetics and, most importantly, drug delivery. Although polymers are not the only matrices that are used, their wide range of properties has made them the materials of choice in many applications.

This volume is derived from the papers presented at the ACS Spring Meeting in April 1992 and has all of the strengths and weaknesses of such symposium volumes. The range of topics is eventually determined by attendance at the original meeting and the camera-ready production method means that there is little opportunity for editorial control of style or content.

The three opening chapters provide a general review of the idea of controlled release and its realization in the fields of pharmaceuticals, cosmetics and food. These are very useful up-to-date reviews with good references.

The rest of the book consists of 25 chapters across the whole field of polymer-based delivery systems. Given the vast range of controlled-release technologies, the balance is reasonable. There is some emphasis on encapsulated systems and on biodegradable polymers and a good deal of discussion of transport properties in polymers. Other topics, like magnetically controlled release and targeted delivery, receive less attention. A number of relatively novel devices are described including delivery systems triggered by heat and those triggered by electronic means.

This book will certainly be of interest to anyone working in the field. Although it has an inevitable unevenness and variability of style, a feature of symposium volumes, it does give a nice combination of general reviews and recent developments across a wide range. This is certainly a book worth having for anyone working in the field. It will also be of value for people wanting a general overview of the current status of research in this area. This book can be recommended to both the specialist and the general reader.

N. C. Billingham

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Organic Materials for Non-Linear Optics III. Edited by G. J. Ashwell and D. Bloor. Royal Society of Chemistry, 1993. Pp. xii + 362. Price £59.50. ISBN 0-85186-625-5

The third in the OMNO series of conference proceedings again shows a good balance between the various sub-fields that can be grouped under the general heading of 'organic materials for non-linear optics'.

As the editors note the main field of interest has significantly shifted towards all aspects of preparation and characterization of polymer films for both χ^2 and χ^3 applications. This interest has of course been to the detriment of such areas as crystal growth but that perhaps reflects the requirement for the fabrication of such materials into device-type formats.

Various new synthetic schemes, which try to overcome the efficiency *versus* transparency trade-off, are also well documented, which shows how far the search for new materials has come from the days of large scale powder SHG testing. The book has not been rigidly separated into sections but has been sensibly laid out starting with theoretical studies and is followed by papers on Langmuir–Blodgett films, χ^2 and χ^3 materials, through to characterization techniques and, most crucially, practical device applications, which complete the book.

One area that was not particularly well represented was that of practical blue light generation, which, technologically, is extremely important, with only one paper on this subject. However, all other areas especially Langmuir–Blodgett films are covered in a considerable amount of detail.

The readability of the book is not affected by the various founts used by the contributors. In fact the presentation of all the papers is of an extremely high standard. This book is ideal for those researchers who wish to keep abreast of all areas of activity in the field of non-linear optics.

G. S. Simpson

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Structure and Properties of Ceramics. Edited by R. W. Cahn, P. Haasen and E. J. Kramer. *Materials Science and Technology, Volume 11.* Volume editor, M. V. Swain, VCH, 1994. Pp. xvi + 842. Price DM 450.00. ISBN 3-527-26824-3 (VCH, Weinheim); 0-89573-699-3 (VCH, New York).

This is an important volume in a distinguished series. Many of the chapters provide long overdue reviews of this area of materials science and technology, which has been the subject of rapid change in the last ten years. The aim of the series is

to provide texts that can be close at hand for frequent reference or systematic study and to work rapidly enough to avoid them being badly out of date. The individual volumes are more detailed and searching than an encyclopaedia or concise review article but less detailed than an individual monograph. This volume is directed at a readership that would include those active in diverse disciplines, such as solid-state physics, solid-state chemistry, electronics or ceramics. Each chapter is written by distinguished scientists who have contributed to the fields concerned and the editor of this particular volume has also been a distinguished contributor to the field.

The coverage of ceramic materials is virtually complete and specific, structure-related properties include diffusion, fracture, toughening, strength, high-temperature behaviour, superconductivity, ferroelectricity, ferromagnetism and semiconductivity. Each chapter has a very comprehensive list of references up to 1990 with some individual references into 1991 and 1992.

Ceramics are of course particularly complex materials with very strong interactions between their chemistry (on both a macro- and a micro-scale), their physical parameters, their processing, as well as the environment (both physical and chemical) in which they are used. The chapters on materials and properties properly consider all these aspects as appropriate to their focus and mostly carry this through into devices and products making use of particular materials or properties. In some instances this produces a rather compressed discussion, such as in the section on triaxial silicate systems. This approach also has the disadvantage of overlap between some of the chapters although it does mean each chapter can stand alone as a monograph. I would not from these comments wish to give the impression that the text is discursive; much of the time considerable detail is given. The chapter on toughening and in particular the section on mechanics of toughening and toughening mechanisms is a good example of the authors providing much detail and a *contextual* framework for the mass of literature that has accumulated in the last few years in this area.

The writing style is direct with a very high quality of English that probably owes a lot to the standards set by the series editors and the contribution of the publishers' editors. The quality of photographs, graphs, tables and print is very high and these factors enhance the book's readability and ease of use by both the browsing reader and the more devoted reader.

If you are an advanced undergraduate, researcher or research student looking for a starter text or a researcher who needs information in a field tangential to your main interests, you should find this text very useful. If you are an expert in a particular field you might still find the text interesting to read since the authors have taken the broader text-book view deliberately to try and bring out principles as well as provide as much detail as possible.

As you may detect, I believe this book is a useful and possibly major contribution to the ceramics literature and should certainly be on the shelf of every ceramics library. At about £180 I suspect it will not creep onto the shelves of many individuals except on long loan. A pity, but nevertheless a very good reference book.

G. J. Gittens

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