

### Acknowledgements

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## Book Reviews

### Boron

Volume 2: Preparation, Properties and Applications

G. K. Gaulé (editor)

Pp XV + 345 (Plenum Press, New York, 1965)  
\$12.50

This collection of papers is based on the second symposium on boron held in Paris in 1964, following the first symposium in 1959. It is divided into four groups: concerned with synthesis, crystal structure, electronic and mechanical behaviour, and some electronic applications.

The complex allotropy and intricate directional bonding of boron in its various structures is still not entirely unravelled, though the complete structure determination of beta-rhombohedral boron with 105 atoms per unit cell is a major achievement. One paper, on a new form of boron produced by subjecting ordinary boron to high pressure, has an indicative opening sentence. "Elemental boron can be prepared at low pressures in something like four different crystalline modifications."

Most of the papers on properties are concerned with band structure, optical absorption, birefringence, resistivity and semiconducting parameters, and thermal conductivity. Two very interesting papers in this section deal with the

strength of bulk boron and of boron filaments, especially with the influence of surface polishing. Boron appears to show no trace of plastic flow, and if the surface is properly treated, filaments of the metal, vapour-deposited on a tungsten core, have very promising characteristics which have recently set in motion a large, American, research effort directed to the production of fibre-reinforced metal composites. These have properties comparable to the carbon-fibre-reinforced composites recently announced in Britain; carbon fibres, however, have the advantage of being much cheaper.

The final section includes a detailed account of thermistor pairs based on two isotopes of boron. These thermistors are used as neutron dose-rate meters, since one isotope has a much larger neutron capture cross-section than the other, and this electrode therefore becomes warmer than the other. This must be the most ingenious dose-rate meter invented to date! The other paper describes the use of a simple boron semiconductor device (not requiring any doping) as a switch, which can be activated either by a current surge or by a temperature change. The use of such a device for various circuit functions such as overload protection and rectification is exemplified. The volume spans a wide range of topics and should offer stimulation to a number of readers, ranging from crystallographers to electrical engineers.

R. W. CAHN

## Introduction to Polymer Crystallisation

A. Sharples

Pp v + 138 (Edward Arnold, 1966) paperback 16s, hardback 32s

In the author's own words in the preface – "this book is concerned with presenting an introductory digest of current comments in this rapidly developing field and at such a level that it can be used by workers in related areas of polymer research without the need for extensive supplementary reading . . . It is also hoped that the presentation will be at a suitable level for use by Honours students in Materials Science courses." In my opinion, this aim has been achieved. I would add that it also provides a valuable first reading for those who intend to start working in the field itself. Whilst criticism could be levelled against many of the individual points in the book, it needs emphasising that it has an overriding consideration in its favour: it is the only one in existence for introductory or supplementary reading covering such a wide ground. Its position in relation to the only other books on this topic ("Polymer Single Crystals" by P. H. Geil, Interscience, 1963; "Crystallisation of Polymers" by L. Mandelkern, McGraw-Hill, 1964) is quite clear. The books just named are for the specialist already working in the field, or at least for those who already possess a reasonable perspective of the broad subject, and wish to give it more serious study. Sharples' book can be read with profit and ease by anyone with a basic science training and requires no previous acquaintance with polymers. Geil's textbook has the main emphasis on the structure and morphology; Mandelkern's on thermodynamics and kinetics of crystallisation. In contrast, Sharples' much smaller book encompasses all these subjects, with the process of crystallisation being the central theme. In this respect too, the book stands alone. The consistent concentration on essentials in such a broad and complex subject is its strongest feature.

Wide coverage, small size, easy readability have their inevitable dangers. Firstly, many of the great complexities of the subject may appear to the reader as comparatively simple matters, and a feeling of unjustified definitiveness is gained. This is particularly so in a subject which is not formalised, and is riddled with controversies not only as regards matters of detailed interpretation but also as regards the broad

qualitative concepts. There is the danger of the reader deluding himself that he now really knows how polymers crystallise and takes some of the concepts and classifications unduly seriously. The history of the subject has taught us many lessons, some of which could well be brought home with profit. In my opinion, the book, while not definitively lacking in this direction, could have done more to stress the point.

Secondly, none of the subjects are dealt with in any depth. While the book tells a fascinating story very successfully, it is essentially descriptive, seldom answering or even asking the question "Why?". However, I suppose this is a limitation intrinsic to a book of this brevity and scope and this has to be accepted as such.

Thirdly, there is the problem of references. Clearly a comprehensive bibliography would be prohibitive, therefore a few references are chosen for further reading. These are mostly comprehensive articles or books however, interdispersed with a few original papers. I feel that the choice in this latter respect is very arbitrary. The same applies to individual works named in the text, which are often arbitrarily chosen from a large volume of relevant material. In many cases, no bibliography accompanies these references. The reader may well have difficulty finding his way to the source.

The book is neatly divided into 10 chapters – Introduction, Morphology, Methods for Characterising Structure, Overall Kinetics of Crystallisation, Secondary Crystallisation, Nucleation, Growth, Melting Factors affecting the Crystallisation Process, and Properties related to Crystalline Morphology. It professes to include morphology as a complementary topic only; nevertheless, this subject turns out to be much more important than that, as it forms the basis for much of the latter content of the book. There is a considerable arbitrariness in the morphological classification introduced. The attempt to bring in natural products is very commendable as this is usually missing in other similar accounts. However, the concept of "fibril" as a unifying feature between natural polymers and spherulites in synthetic materials is very tenuous and may well be incorrect, particularly as in our present knowledge the "spherulitic fibril" is a degenerate form of layer growth rather than the result of intrinsically fibrous crystallisation. This unsatisfactory "fibril" concept reappears also in later parts of the

book. Figure 2.6 as a definitive proposal for the morphology of the melt-crystallised material is certainly naïve and would require much qualification. It is one example of deceptive simplifications referred to earlier.

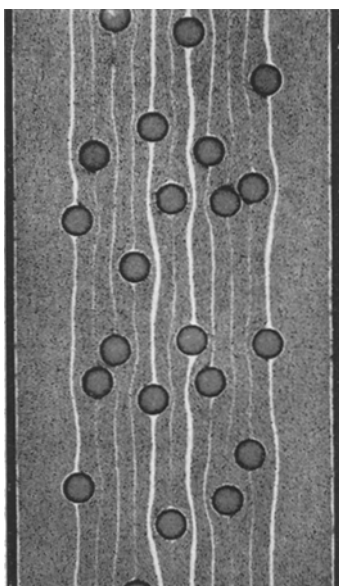
Chapters dealing with the kinetics and associated topics are the strongest ones in the book. Particularly salutary is the reminder of some of the limitations of the usual kinetic analysis. (I say some, because not all are mentioned in the book – at least one significant misuse of the “Arrami” analysis, its indiscriminate extension to disc- and rod-shaped crystals is further propagated in keeping with nearly the entire literature on the subject.) This ought to be widely read and heeded even by specialists. The excellent account on persistent nuclei reflects the author’s own significant contribution to the subject.

The short chapter on melting is a very lucid,

descriptive summary of a big subject. The last two chapters become increasingly sketchy; nevertheless, it would be difficult to find all this laid out in a coordinated form elsewhere within even comparable length.

Summing up, this is a book which may be easy to fault but which would be difficult to improve on other than on specialised points. Accepting the qualifications made earlier, it fills a definitive need. The reader may not learn everything that is important in the subject, he may not even always learn what some of us may now judge as the right thing, neither is he introduced to many of the basic physical issues. However, he should acquire a balanced appreciation of the major factors and variables involved in this large complex of problems within a short reading. In this respect, the book does a great service and is most welcome.

A. KELLER



## A valuable book for Metallurgists

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**Science of Materials***T. J. Lewis, P. E. Secker*

Pp 256 (Harrap, 1965) 27s 6d

In the past few years, we have seen several excellent books dealing with the science of materials, each covering roughly similar ground. This new book lacks originality and follows the general pattern in giving the reader a wide survey of atomic theory, molecules, and atomic bonding, and the properties of vibrating molecules. Having introduced the reader to crystals, the kinetics of phase changes and properties of the nucleus, the authors seek to relate these fundamental concepts to practical materials in Chapter 12, which is headed "Real Materials and Their Predicted Behaviour". It is in this chapter that the weakness of this book becomes apparent: the survey of metals is so short as to be practically useless, little or nothing is mentioned of aluminium or copper and their alloys, and steels are dismissed in two pages. Semi-

conductors seem to receive the same scant treatment.

However, there is an excellent discussion and survey of high polymers and ceramics. The basic formation mechanisms of addition and condensation polymers are clearly explained and several useful examples are presented by means of diagrams.

Although, by necessity, the treatment in a book of this size must be very limited, a good bibliography at the end of the text extends its usefulness to the enquiring student. It is gratifying to see that the index at the end of the book is very full and will be of great assistance to a student, although one or two of the references the reviewer looked up were not amplified in the text. Apart from the section on metallic materials, this book may be usefully recommended to students attending the new courses in materials science and will be attractive at the price.

R. A. FARRAR

**Introductory Practical Metallography and****The Role of Microstructure in Metals***A. R. Bailey*

Pp 32 and 63 respectively (Metallurgical Services, Betchworth, Surrey, UK, 1966) 12s 6d and 16s 6d respectively

These are two attractively produced paperbacks published by Metallurgical Services, who also supply a range of annotated metallographic specimens which are supplied under the same name. The booklet describes the techniques of grinding, polishing, and etching the specimens, though without pointing out that the vital first step of sectioning the specimen has been previously carried out, so that it is not the original surface of the sample that is being studied.

The text deals with each of the 30 specimens suggesting polishing schedules and suitable etchants, thus allowing the student to work steadily through the series. For each sample, a sketch of the relevant portion of the equilibrium diagram is included, together with a drawing of what the structure should look like.

This course has been well designed to give a good selection of possible metal structures and the reviewer had only two major criticisms of the content – one is that no magnifications are

given for the sketches, a bad habit that no student should be allowed to acquire, and, second, that the comments about each sample are rather too brief.

The second volume, "The Role of Microstructure in Metals", provides a background of information in elementary physical metallurgy which is required in order to understand the structures observed in metallography. This volume is less successful, since insufficient space is available between the 72 figures to allow even the elements of the subject to be properly introduced. Thus crystal structure is introduced by a comment that "within metal grains the overall pattern of the atoms is essentially regular", with no further comment; likewise, the concept of free energy is introduced without definition. The reviewer would not, therefore, like to see this volume recommended to students as an introductory text in physical metallurgy, the role of microstructure interpretation being only a part of that subject.

However, as a supplementary volume illustrating microstructure, this volume is quite successful and could be acceptable in any laboratory where metallography is being taught, in order to show that if the rather tedious skills of specimen preparation are acquired the results can be very pleasing as well as instructive.

R. D. DOHERTY

**Conférence Internationale sur La  
Métallurgie du Béryllium, Grenoble 1965**

Pp 692 (Presses Universitaires de France, 1966)  
NF 115

Within the space of five years, interest in beryllium as a material for nuclear engineering has been replaced almost totally by an interest in it as a potential structural material. This is a conclusion that can be drawn from these published proceedings of a meeting, held in May 1965, which was attended by specialists from nine countries. The meeting was organised by the Department of Metallurgy of the Commissariat à L'Énergie Atomique and the Centre d'Études Nucléaires de Grenoble under the patronage of the Société Française de Métallurgie. The Proceedings contain principal lectures by McLean and Conrad, together with sixty other contributions and their related discussions. The meeting was divided into seven sessions dealing with many aspects of the chemistry, physics, and metallurgy of beryllium. The policy of the organisers was to devote most of the meeting to fundamental research, but the final session contained much that was of interest to manufacturers and (potential) users of wrought and other commercial products.

This is not a tome for the general reader. It is manifestly a working volume for those in the field. While it appears to have been the compilers' intention, somewhat unreasonably, one feels, to keep drawings and photographs at their

original size in the finished book, the text print size has been reduced to the point where perfect vision or strong lenses are necessary to read it. It is therefore extremely hard to locate, in one of these foolscap-sized pages of print, any particular item that one might be seeking. In view of this information-retrieval difficulty and the density of factual detail presented, the provision of a subject index, however simple, would have been a worthwhile labour. Captioning of figures is haphazard and often non-existent, and some ruthless editing of text and illustrations would not have been amiss. Despite the organisers' subdivision of the meeting into seven categories, the contents of this volume fall readily into three sections. The first describes chemical and physical behaviour, viz. purification, analysis, corrosion and oxidation, lattice dynamics, and effects of irradiation. The second section, which is by far the longest, deals with the mechanical properties of monocrystals, polycrystals, and wrought products; the remaining section is technological. These three might have been published separately in a better quality format, and each section should, perhaps, have been rounded off with some critical analysis and general conclusions by a rapporteur. As it is, one gets no clear impression, from reading the separate conclusions to each paper, of the exact state of knowledge or of which problems have been solved and which remain to be solved.

B. HARRIS