Book Reviews

Works intended for notice in this column should be sent direct to the Book-Review Editor (M. M. Woolfson, Physics Department, University of York, Heslington, York YO1 5DD, England). As far as practicable books will be reviewed in a country different from that of publication.

Mössbauer effect methodology. Vol. 5. Edited by IRWIN J. GRUVERMAN. Pp.viii+278. New York: Plenum Press, 1969. Price $19.50.

This is the latest volume of a series aimed at providing 'a continuing forum for publication of developments in Mössbauer effect methodology and of spectroscopy and its applications'. Each volume records the proceedings of a symposium held annually in the U.S. under the sponsorship of the New England Nuclear Corporation. As in previous volumes the book is subdivided into sections; in this case Spectroscopy (6 reviews), Applications (4 reviews) and Methodology (5 reviews).

The spectroscopy section has a strong chemical-physics content with articles on semiconductor and organometallic Sn compounds; inorganic Sb compounds; organometallic compounds in noncrystalline matrices; Eu mixed oxide structures; and isomer shifts in Sn, Sb, Te, I, and Xe. The other review in this section deals with studies of vitamin B_{12} and related cobalamins.

In the applications section one article discusses polarization effects in single crystals. Another deals with the determination of zero-point phonon parameters and describes a new method of combining recoil-free fraction measurements with second order Doppler shifts so as to permit deduction of the absolute zero-point mean-square velocity. Such calculations should prove useful in testing theoretical models of impurities in crystal lattices. The third article in this section discusses the information obtainable from studies of microcrystals. This information relates to surface effects, 'internal pressures' (which can be as high as ± 200 kbar), preferential stabilization of various chemical valence states, and magnetic effects such as superparamagnetism. This section's final article discusses the after-effects of Auger ionization following electron capture in cobalt complexes.

The methodology section begins with a review of Mössbauer applications in radioactive materials, in which unstable isotopes may be used as absorbers thus expanding the field of nuclear and solid state investigations. A method of measuring diffusion by observing the broadening of Mössbauer lines is also discussed, although the method is not as 'new' as the authors claim since similar measurements were done on solids and liquids in the early sixties (Boyle, Bunbury, Edwards & Hall, *Proc. Phys. Soc.* (1961). **77**, 129; Bunbury, Elliott, Hall & Williams, *Phys. Letters* (1963), **6**, 34). A third article is of interest to mineralogists as it describes Mössbauer methods for determining mineral contents of rocks, ferric–ferrous ratios, *etc.* A final paper reviews the design and application of He^3/He^4 dilution refrigerators to Mössbauer work. This is a relatively new development which opens up a whole new range for experiments requiring continuous temperatures down to 0.03K. The basic refrigerator principles are reviewed together with a description of the cryostat required. Applications include the observation of very low temperature magnetic transitions, paramagnetic relaxation, and localized magnetic moments including the Kondo effect. The use of the Mössbauer effect as an absolute thermometer is also described.

As a result of their wide coverage these volumes should be of interest to many physicists, chemists, biologists, metallurgists and geologists, and would form a valuable addition to their libraries. Most Mössbauer workers, however, will want to make more frequent reference to these books and idealy will want them closer at hand. This recent volume (and more are promised) is a most useful addition to the series, but it is the series as a whole which is to be recommended.

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Elements of X-ray crystallography. By A. J. C. WILSON. Pp.ix+256. London: Addison-Wesley, 1970. Price £6·90.

This book fills a definite gap between several existing rather simple books on X-ray diffraction, in which its various applications are at best treated qualitatively correctly, and the more exhaustive and rigorous treatment of various textbooks on powder diffractometry on one hand, and structure determination on the other.

To find a book of just over 200 pages adequately covering such different fields as systematic errors in powder diffractometry, intensity of X-ray diffraction, and diffraction by imperfect crystals, is quite a revelation to the university teacher who has in vain wrestled with the problem of how to cram all this into an introductory course. The reviewer notes with delight some clever didactic tricks, such as the derivation of the Patterson function. On the other hand, an introduction of vector notation right from the beginning of Chapter 8, instead of halfway through, would have had the advantage of avoiding introducing the non-informative notation 'θ_i' for $2\pi\mathbf{h}.\mathbf{r}_i$.

Inevitably, some subjects have been carried further than others, clearly depending on the author's special interests. Especially these parts of the book provide very stimulating reading.

The chapter on crystal structure determination does show how fast this application of X-ray diffraction develops: although the book was apparently written in 1969, this part is already slightly outdated. For instance, the effectiveness of the sign-relation method of solving structures is definitely underestimated on p. 170; *cf.* the many successes scored by the Karles and others. Also, the heavy-atom method does not depend quite so much on 'favourable circumstances' as stated on p. 182, certainly not in the case of centrosymmetry and if three-dimensional Fourier methods are used. It might have been useful to point out that the Patterson and the sign-relation method are often complementary, in the sense that where one fails, there is a good chance that the other may be successful.

In most chapters this small book covers surprisingly deeply many aspects of X-ray diffraction. The necessary mathematics are not shunned, but the approach is such that a moderately bright student will not be deterred. Problems and judiciously chosen references for further reading are given at the end of each chapter and add to the usefulness of the book.

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Principles of crystal structure determination. By GENE B. CARPENTER. Pp.xii + 237. New York: Benjamin, 1969. Price not known.

This book takes the reader from a brief discussion of crystals, through a description of the diffraction of X-rays and crystal symmetry, to a review of the main methods of structure determination and refinement. It should be tested against the author's intentions, which he states in the preface to be the provision of 'a concise introduction' useful to those interested in structural results as well as those engaged in structure determination.

One of the shortcomings of the book stems from the author's preoccupation with brevity. The preface refers on five occasions to this feature of the book. Unfortunately, brevity is not always a virtue, and in this book, it has resulted at times in a breathless pace which is exhausting. This rapid style perhaps comes from the fact that the book is the evolution of a graduate level course, given by the author and the writing still has the ring of a lecturer's notes.

The book fails to meet the needs of those interested in structural results, because it largely belies its title. There is a lack of emphasis on principles, so that topics of widely differing importance receive comparable treatment. Methods for sharpening the Patterson function receive as much space as the discussion of the heavy atom and isomorphous replacement methods.

A chapter which characterizes the book is the short one on the reciprocal lattice. In the space of sixteen pages, all the important properties of the reciprocal lattice are discussed. The lecturer or the class student has all that he needs to hand. But, the idea of the reciprocal lattice is introduced without any justification, perhaps by an appeal to the Laue equations. Given that the lecturer will do this for his students, the chapter is an excellent précis of the properties of the reciprocal lattice. But, a novice reading the chapter for the first time, will require convincing that he has not seen a rabbit pulled from a hat. It is certainly easier to define the reciprocal lattice and then to show its physically significant properties, but in a book which claims to be an introduction to the subject, surely the reader is entitled to receive some evidence of its usefulness before embarking on a formal definition of a mathematical abstraction.

One of the stimulating features of the book is the author's brave attempt to depart from the conventional order of treatment of the subject. Anyone who has attempted to construct a lecture course knows that, while it is essential to introduce symmetry early in the discussion, this is *a priori* the least interesting part of the subject for the beginning student. Professor Carpenter has delayed the discussion of symmetry until after the treatment of the geometrical and physical aspects of diffraction. Although the resulting treatment is not perfect, it must encourage the teacher to adjust his order of presentation to suit the interest of his class.

Because of the lack of stress on the principles of the subject and the very brevity of the text, it seems unlikely that the individual student would find this book as suitable as comparable texts for solitary study, or for general background reading. However, it should be useful to lecturers on X-ray crystallography, and in many cases could profitably be used as a class text. In addition, the practising crystallographer would find this book a concise and complete *aide memoire* on the basic facts of his subject.

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Crystallographic computing. Proceedings of the 1969 International Summer School on Crystallographic Computing. Edited by F. R. AHMED. Pp. 383. Copenhagen: Munksgaard, 1970. Price D.kr. 187,50, £ 10·94

This book contains the proceedings of an International Summer School on Crystallographic Computing organized by the Commission on Crystallographic Computing of the International Union of Crystallography and held in Ottawa at Carlton University, 4–11 August 1969. There were 38 invited speakers on 14 topics covering the following aspects of crystallographic computing:

Direct methods of phase determination,
Automatic interpretation of vector maps,
Utilization of anomalous dispersion and isomorphous replacement for elucidation of large molecules,
Least-squares procedures in crystal-structure analysis,
Least-squares refinement of atomic parameters,
Analysis of thermal vibration,
Absorption and extinction corrections,
Organization of crystallographic computer systems,
Programs for computer-controlled diffractometers,
Protein programs
Fourier techniques
Data files,
Algol,
Standard tests.

This work is an important contribution to crystallographic literature and every practising crystallographer should ensure that a copy is readily available. A great deal of the material is very basic and will not date too quickly so that, even though the price of the book is high, it should give many years of service.

It is difficult to comment on details of the presentation of a book with so many contributors – thirty-eight authors constitutes a fairly large sample and the variations of style and clarity reflect this. However the overall impression