The crystal structure of solids. By P. J. BROWN and J. B. FORSYTH. Pp. 172, Figs. 81, Tables 20. London: Arnold, 1973. Price £4·40, (paper) £2·20.

This easy-to-read monograph is part of a series of short texts on topics in solid-state science designed to provide the reader with a fairly complete understanding of basic concepts. It begins with introductory chapters on crystal geometry and the production of X-rays, neutrons, and electrons, whose scattering and diffraction by atoms and crystals is considered next. A brief review of experimental methods is given in Chapter 5, while the next three chapters describe the crystal structures of elements, polar (ionic) compounds, and binary alloys. A five-page concluding chapter acquaints the reader with some of the compendia of crystal structures and indicates how they can be utilized to garner structural information.

The authors' intent, as outlined in the preface, is to provide the reader with an appreciation of the power of diffraction techniques and to give some feeling for the orderliness of crystal structures and how it has provided much insight into their chemical, physical, and mechanical properties. This aim seems to have been achieved successfully, although it is difficult for a reviewer already familiar with the subject to judge just how effectively such concepts can be conveyed within the brevity of the coverage afforded to a relative neophyte, to whom this book is directed. One thing is clear, the reader will need to have a fairly good mathematical grounding, including familiarity with Fourier theory, to follow the central portions of the book, as well as patience to assimilate the rapidly presented catalog of a fairly large variety of structures.

A discussion of organic structures has been omitted because 'they add little to our understanding of structural principles'. Similarly, departures from perfect crystals are not considered, except for a statement in the discussion of extinction that 'normal crystals are made up of large numbers of small blocks of perfectly arranged crystal separated by regions containing imperfections'. This is unfortunate because it tends to ignore the rather extensive literature on the role of crystal defects, disorder, *etc.*, in determining diffraction effects (and other crystal properties), and it serves to resuscitate the 'mosaic' crystal model that was laid to rest 18 years ago by P. B. Hirsch [*Prog. Met. Phys.* (1955). **6**, 263–339].

As often happens with an attempt to condense a rather diverse subject into a short text, various subjects receive uneven coverage, often reflecting the authors' particular interests. Thus inclusion in a discussion of crystal monochromators of such details as suppression of $\lambda/2$ components by choosing the 111 reflection of Ge or Si crystals 'because the scattering power of the (222) planes is zero in this instance', or that Pu can be used with 1 Å neutrons for the same purpose because it has resonant capture at 0·52 Å, may be excessive when a discussion of Pauling's rules must be limited to half a page. These are all matters of taste, however, and do not limit the book's usefulness as introductory (supplementary) reading for a senior or a graduate student in solid-state sciences. The one shortcoming of this book, which can be corrected easily in a later edition, is the relative paucity and unevenness of bibliographic references. A short general listing of 25 papers and books assembled at the end of the text is followed by a list of books and journals containing structure data and a list of books on X-ray structure determination. The latter does not include Buerger's *Crystal structure analysis* (given under general references) but does include proceedings of a 1961 conference on computing methods! A more complete current listing of books and review articles, in which the reader can expand his knowledge of the subjects covered in all nine chapters, would make this book much more useful to students and teachers alike.

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The Raman effect. Vol. 2. Applications. Edited by ANTHONY ANDERSON. Pp.xi + 1033, Figs. 124, Tables 69. New York: Marcel Dekker, 1973. Price $45.00.

This second, final volume of *The Raman Effect* contains five reviews covering the application of the phenomenon to inorganic chemistry, molecular, ionic, covalent and metallic crystals, electronic transitions and high-resolution studies of gases. It complements the first volume (published in 1971) which reviewed general principles, instrumental methods and developments and included sections on the stimulated effect and Brillouin scattering.

The entries in the present volume are mainly well supported by references – if one excludes that quoted (p. 755) claiming that the *Journal of Chemical Physics* was in print in 1670. Three of the articles contain no references later than early 1970, the remaining two apparently dating from the following year despite the 1973 publication date. The last two years have seen an enormous growth of interest in resonance effects in Raman spectroscopy and applications to the study of rapid reactions and molecules of biological interest. These important areas find no place in the present volume and this omission reduces significantly the value of the work. No doubt all research groups in this field will feel obliged to obtain these highly priced volumes for their virtues of inclusion rather than their sins of omission.

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Magnetically ordered crystals containing impurities. By YU. A. IZYUMOV and M. V. MEDVEDEV. Pp.x + 168. Figs. 31. New York: Plenum Press, 1973. Price $34.00.

This monograph is a translation, with corrections, of a text first published in Moscow in 1970. The very high price, for a volume of 165 pages in paperbacked format, will discourage individual buyers. It may be noted that the translation is an excellent one.

The report is a detailed account of the effects on the excitation spectrum of ordered Heisenberg spin systems of the introduction of foreign spins. The analysis is entirely in terms of a localized spin model usually with nearest-neighbor interactions. The impurity spins differ from those of the host either in spin magnitude or in their interactions or both. As originally shown by Lifshitz, this problem may

be reduced to the manipulation of small matrices whose elements are Green's functions for the host lattice. Their dimensionality is one plus the number of interacting neighbors. This relatively simple structure allows the formal analysis of the model to be carried out in considerable detail and the greater part of this monograph is devoted to doing this.

Chapter I gives the general formulation of the problem in terms of Green's function and discusses the impact of considerations of point symmetry. Chapter II deals with a single impurity in a ferromagnet using the boson approximation to the Hamiltonian. Localized and resonant levels, densities of states, antiferromagnetically coupled impurities, temperature dependences of the spin magnitudes and the effects of different host symmetries are treated. Chapter III takes up the nonmagnetic impurity and interstitials. In Chapter IV the analysis is suitably generalized to systems with multiple sublattices, including the two-sublattice antiferromagnet. Chapter V attempts to treat the problem of the antiferromagnetically coupled impurity in a ferromagnet in more detail without using the boson approximation. The application of a DC magnetic field to the impure system and ferromagnetic resonance occupy Chapter VI. Chapter VII discusses the calculation of certain quantities to the first order in the concentrations of impurities. Neutron scattering and the damping of spin waves are among these. Finally, in Chapter VIII, some of the properties of a system containing impurity pairs are considered. The bibliography does not go beyond 1969. There is no index.

Throughout, the exposition is very clear and thorough; it is essentially self-contained so that it can be recommended to anyone approaching the subject. At the same time it has great value as a general reference work. There are some references to experimental work, but these are neither systematic nor critical.

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Crystallographic groups. By T. JANSSEN, Pp. xiii+ 281. Amsterdam: North Holland. 1973. Price *f* 60.00 (U.S. $ 21.10).

In this excellent book the author introduces crystallographic groups in a modern way, but – despite the title – it is not a book on crystallographic groups. Its contents could be better described by the title 'crystallographic groups in solid-state theory'. Crystallographic groups are not dealt with as such but are used extensively as tools for the solution of solid-state physical problems. A rough estimate shows, that approximately 65 pages, may be considered as mathematical, 96 pages are crystallography, 112 pages are physics, and 18 pages are exercises, bibliography, and index. Therefore, less than one third of the book is really concerned with crystallography in the usual sense.

The author starts with a mathematical introduction (groups, linear algebra, representations). There follows a chapter Group theory and quantum mechanics. The next two chapters are devoted mainly to crystallography (crystallographic point groups and their representations, space groups and their representations), but they include also sections on 'crystal field theory' and 'periodic potentials'. Chapter 5 is concerned with 'Spin and time reversal'. Chapter 6 contains some applications in solid-state physics. Exercises, some appendices on character tables, representations, and space-group tables, bibliography, and an index conclude the book.

The presentation of the contents is clear and concise, following in many respects the way indicated in the papers of Ascher, Janner, and the author. It includes a modern treatment of the crystallographic concepts not yet given in crystallographic text books. Therefore it is highly recommended to crystallographers, although it is not easy to read (i) because it is written in a rather condensed form and (ii) because the author occasionally uses conventions in symbols and setting not normally found in crystallography.

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Space groups and lattice complexes. By WERNER FISHER, HANS BURZLAFF, ERWIN HELLNER AND J. D. H. DONNAY. Pp. 184. Washington: National Bureau of Standards, 1973. Price $4.10.

This book gives in tabular form all possible lattice complexes. A lattice complex is an assembly of points equivalent under some space group, and therefore plays the same role as a site set for point groups. Although the concept is already rather old I have never seen a systematic list of all possibilities. As in other concepts in crystallography there is some confusion about terminology and notation. In 1966 a symposium was held in Kiel to settle these questions, including among the participants some of the authors of these tables. Here again an attempt is made to fix the terminology and the notation. However, in my opinion, this goal has only partially been reached. In the first place many notions are defined, but often in a rather descriptive way: a mathematically rigorous set of definitions is lacking. The notation is according to a long list of rules, but although very ingenious the system is not always very clear; it will require quite an effort from the reader to decipher all stars, dots, double dots, Greek letters, capitals *etc.* Once one has understood the system, however, the tables contain a lot of information.

Related to the background is another point of criticism. 402 different lattice complexes are given, derived from 67 so-called Weissenberg complexes. It does not become clear how this result was obtained or whether the list is really exhaustive.

I don't want to go into details for the sake of criticism. The tables can be very useful for the classification of structures. The printing is neat; there are a few misprints in the text, but I hope not too many in the tables.

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