pansion. Many of these properties depend upon the non-harmonic character of atomic vibrations, and Professor Cochran provides brief but adequate discussions of phonon scattering by other phonons, by defects and crystal boundaries, so that the basic physics of each property can be readily appreciated. The similarities and differences between electrons and phonons and between neutron scattering and electron scattering are nicely brought out, as is the importance of the electron–phonon interaction. Finally, the connexion between lattice dynamics and phase transitions ('soft' modes) is very well described in relation to the general problem of phase transitions.

The treatment throughout the book is at a reasonably uniform and elementary level, though perhaps a little too condensed in some places. The newcomer to the subject might appreciate some expansion of the sections dealing, for example, with the reciprocal-lattice concept, anharmonicity and thermal conductivity. There are no explicit exercises for the student, but he is encouraged to work through some of the derivations and perhaps find a few 'deliberate mistakes'! (*e.g.* Fig. 3.4). This leads me to a relatively minor but general criticism of the book: the typesetting, alignment of margins and the overall appearance of some of the pages are somewhat below the average standards for scientific textbooks. There are also, inevitably, a few typographical errors which should be corrected in future editions. Nevertheless, at £2·30 for the paper-back version, this little book is an absolute 'must' for anyone starting to learn about the motions of atoms in crystals. Highly recommended.

G. DOLLING

Atomic Energy of Canada Ltd.
Neutron and Solid State
Physics Branch
Chalk River Nuclear Laboratories
Chalk River
Ontario
Canada K0J 1J0

Computed electron micrographs and defect identification. By A. K. HEAD, P. HUMBLE, L. M. CLAREBROUGH, A. J. MORTON and C. T. FORWOOD. Pp. x + 400. Figs. 133, Tables 22. Amsterdam: North Holland, 1973. Price U.S. $40.00.

For those who have followed the work of this Australian school the book holds few surprises. It is a review of their considerable contribution to the subject in recent years. However the book is in no sense a stringing together of published material, nor is it evident that the work is produced by several authors. In fact the presentation of the book has been very carefully thought out, with some excellent introductory chapters which will be particularly valuable for those coming to the subject for the first time. Computer programs, some of which have been freely distributed in the past, are here thoroughly introduced and explained and listings of the programs are given for cubic, hexagonal and tetragonal crystals. The text is illustrated with a rich variety of examples, although they are largely drawn from work on f.c.c. and b.c.c. metals and alloys with relatively little work on other crystal systems or on ceramic materials. Impressive agreement between experiment and theory is demonstrated. The authors are careful to emphasize the limitations of their technique though there is very little discussion of many-beam diffraction effects and no reference to weak-beam work. Moreover, the approach is essentially limited to straight dislocations, not too close to crystal surfaces, with distortions calculated from linear anisotropic elasticity theory.

As far as the identification of perfect dislocations is concerned some may feel that the philosophy of the Australian school is misguided. They deliberately examine situations of extreme pattern detail, using relatively thin foils, inclined dislocations and close reflecting planes. Apart from the fact that this approach is not applicable to layer structures many experimentalists will prefer to work with thicker crystals, mid-foil dislocations and widely separated diffracting planes where the problem is altogether simpler, and analytic expressions for elastic distortions can unambiguously provide the required information without recourse to elaborate calculations. However there can be little doubt about the value of the computed micrograph technique for studying the partial dislocations bounding stacking-fault configurations, and this problem is thoroughly discussed.

In view of its price this book will not be purchased without good reason but it must surely be available in the library of any laboratory regularly studying defects in materials and it will certainly prove most valuable in the training of research students.

J. W. STEEDS

H. H. Wills Physics, Laboratory
University of Bristol
Tyndall Avenue
Bristol BS8 1TL
England

Crystal structures - a working approach. By HELEN D. MEGAW. Pp. xviii + 563. Figs. 208, Tables 42. London: Saunders, 1973. Price £8.30

The results of a crystal structure analysis can be summarized in a set of data (space group, lattice parameters, atomic coordinates, *etc.*) which usually constitute an essential part of an original paper. The data are given together with a discussion of the methods used, of the reliability of the results and with a description of the structure as seen from the point of view of the author in its relation to the particular chemical, physical or purely crystallographic problem which led to the research. But it is possible to obtain a variety of views of a crystal structure, starting from the same fundamental data. To do this it is necessary to know how to interpret the conventional symbols and to be trained in dealing with crystal geometry. That is what the author of the book wants to teach and that is what the subtitle 'a working approach' means. Indeed the purpose of the book is to show how crystal structures ought to be looked at in order to obtain from them the particular information in which one is interested. The importance of this is self-evident since a knowledge of crystal structure is fundamental in interpreting many aspects of modern solid-state physics and chemistry.

The plan of the book is developed for that purpose. The first three chapters are introductory in character and deal with general concepts of crystal-structure building, interatomic forces in crystals and the lattice nature of crystals. In the third chapter a number of simple fundamental struc-

tures are examined applying the concepts previously introduced. Theoretical aspects of geometrical crystallography are more deeply considered in the following six chapters in which the main aspects of lattice geometry and crystal symmetries are treated. In the successive three chapters all these concepts are systematically applied to the description of the most relevant and representative types of crystal structures, *i.e.* oxides, 'families of structures', hydrogen-containing compounds. In the last two chapters thermal effects and phase transitions are treated mainly from the geometrical and lattice-dynamical point of view.

At the ends of the chapters are summaries emphasizing the main points and there are well chosen exercises which can be used to test how well the concepts have been learned. The references given at the end of the book allow the reader to extend his knowledge about many topics and to become acquainted with original works.

The book is particularly well written, clear, logically developed and provides stimulating reading. All the subjects have been treated exhaustively and rigorously within the imposed framework. The reviewer was particularly pleased to note how well the author has succeeded in putting over her experience as an outstanding researcher in the field. The book, which is recommended to all who are directly or indirectly interested in crystals, will certainly contribute to the spread among non-crystallographers of a better knowledge of modern crystallography.

M. NARDELLI

Istituto di Chimica Generale ed Inorganica
Università degli Studi di Parma
Via M. D'Azeglio 85
43100 *Parma*
Italy

Atomic diffusion in semiconductors. Edited by D. SHAW. Pp. xiii + 607, Figs. 199, Tables 56. New York: Plenum, 1973. Price $32.00.

This book fills a gap which has existed for a number of years. Considering the importance of diffusion processes in the processing of semiconductor devices it is incredible that the last book of any value on this subject was published in 1963. This latter work was grossly inadequate even then, and with the rapid advances in the field made in the last ten years it is practically true to say that this is the only serious attempt to do justice to this field. With some exceptions I feel that the editor has succeeded in this objective. The work will be of immense value particularly to those engaged on research in this and related fields, and also to those engaged in the practical exploitation of diffusion processes in the semiconductor industry. The high level of sophistication of the material puts it above the level of most undergraduate readers, but it could find a place in specialized postgraduate courses, and as a general reference work in the subject.

The book is edited by D. Shaw of Hull University and consists of chapters by different authors on various aspects of the subject. The first chapter, by the editor, discusses general features of diffusion in semiconductors followed by a theoretical chapter on the calculation of diffusion coefficients, by R. A. Swalin. J. C. Brice has written the next chapter on phase relationships followed by T. H Yeh on experimental methods. The final four chapters each discuss particular semiconductor materials: S. M. Hu on silicon and germanium, H. C. Casey on III–V compounds, D. A. Stevenson on the chalcogenides of Zn, Cd and Pb, and J. Bruce Wagner on oxide semiconductors. In general these reviews are at a very high level, written extremely critically and with good coverage of the available literature – one chapter references nearly 400 papers.

The shortcomings of the book are minor compared with its achievements, but they should be mentioned. Its principle shortcoming is the lack of a simple introduction for the newcomer to the field, or the non-specialist. Such a person would be lost in the first chapter and the book really needs a good general introduction to basic diffusion. The readership is somewhat limited by this omission to those well versed in the field.

My second criticism is the inclusion of Chapter 3 on phase relationships. This chapter is justified by the editor as due to the fact that 'diffusion processes are crucially affected by conditions in the phase external and adjacent to the specimen', and he states that 'the role of these conditions on point defect concentrations within the semiconductor is the substance of Chapter 3'. It would have been admirable if this were what Chapter 3 actually did, but in fact Chapter 3 is really mainly about crystal growing, containing sections about the facet effect, cases of imperfect stirring *etc.*, none of which bears the slightest relevance to the subject in question. The aim of the editor really needed to be realized in the book.

Thirdly, by far the weakest chapter, in this reviewer's opinion, is that on diffusion in the III–V compounds. This is much too heavily weighted towards a description of the author's work on defect equilibria in gallium arsenide, without even a mention of the really authoritative work on this subject by Logan and Hurle. Likewise the rest of this chapter is excessively selective in coverage of material – there is not even a reference to the extensive work of B. Tuck on the diffusion of zinc in gallium arsenide. It is a great pity that such a weak chapter on these important materials should be included, particularly in view of the extremely comprehensive chapter by Hu on diffusion in the elemental semiconductors.

A final criticism is that there are a number of important inconsistencies between chapters: it would have improved the whole work had they been resolved. In Chapter 5 Hu points out, quite correctly and with excellent argument, that the self-diffusion data of Ghostagore are subject to considerable experimental uncertainty, if not totally meaningless. Unfortunately, in Chapter 2, Swalin uses *this same data* to conclude that this supports the vacancy mechanism of self-diffusion for silicon, without even a mention of the experimental uncertainties. Instead Swalin indulges in an unnecessary argument about the detail of a degeneracy calculation, while clearly the experimental factors outweigh all other considerations.

Despite these reservations, the editor is to be congratulated on the success of this work, and one can happily recommend this as an excellent up-to-date treatise on the subject.

A. F. W. WILLOUGHBY

Engineering Materials Laboratories
The University
Southampton SO9 5NH
England