

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.

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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.

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