Book Review

Works intended for notice in this column should be sent direct to the Editor (P. P. Ewald, Polytechnic Institute of Brooklyn, 99 Livingston Street, Brooklyn 1, N.Y., U.S.A.). As far as practicable books will be reviewed in a country different from that of publication.

Les Dislocations et la Croissance des Cristaux.

By W. DEKEYSER and S. AMELINCKX. Pp. viii+184 with 80 figs. and 23 plates. Paris: Masson. 1955. Price 2,000 fr.

An important part of the theory of dislocations is concerned with the geometry of crystals containing them, and many interesting ideas have arisen in this study. The proposal by Frank about the role of screw dislocations in crystal growth is one which has received striking confirmation. One of the most fascinating steps in the instruction of those learning about the crystalline state must surely now be their introduction to the beautiful and simple experiments on the growth of cadmium iodide. Because of the singularities in it, the crystal grows, not as a sequence of parallel atomic planes, but as a complex interleaved Riemann surface, as used in the theory of functions; one wonders, indeed, what Riemann's reaction to the phenomenon would have been.

It is now recognized that dislocations play an important role in most phenomena in the crystalline state which depend essentially on the *imperfection* of real crystals. When the growth spirals were observed on beryl by Griffin, however, interest in dislocations was still largely confined to those concerned with the theory of metal plasticity. Important initial aspects of the work were thus the direct evidence provided for the existence of these defects in crystals, and the explanation afforded of their presence by the demonstration of how the imperfect crystal could outstrip the perfect in its rate of growth. The work is interesting as an illustration of the impact of one field on another, for this initiative from metal plasticity has given renewed impetus to the study of many aspects of the growth and morphology of minerals and non-metallic crystals. It is indeed in this field that much of the authors' own contribution to the subject has been made. Commenting on the already extensive list of examples exhibiting the phenomenon of spiral growth, they remark (p. 100):

'Il est assez curieux de constater que les métaux n'y étaient presque pas représentés au début, et que les données expérimentales sur les dislocations, défauts de réseau imaginés essentiellement pour expliquer les propriétés plastiques des métaux, sont surtour fournis par des non-métaux.'

Another striking feature of this development is that it shows how important it is to combine effectively both theory and experiment. For it has been found that the presence of spirals on crystal faces had been previously reported (p. 100) without their significance being realized, while, on the other hand, the experiments on crystal growth have greatly stimulated work on all aspects of dislocation theory.

This well executed work is to be recommended as a comprehensive and readable account of the present position of the subject. It covers the same general ground as the earlier work in English by Verma (1953), but includes some later developments and treats some subjects in rather more detail. The first chapter presents a brief descriptive account of the relevant parts of dislocation theory. With the aid of good diagrams and the minimum of mathematics, this 33-page introduction achieves its object, and adequate references are given for further reading. However (p. 7), while isolated positive and negative edge dislocations differ only in orientation, it is always possible to determine the sense of a screw! Also, although the authors cite (p. 28) the first paper on the 'atmosphere' effect, which deals with the hydrostatic interaction, it is now rather misleading without further explanation to imply that an atmosphere is not anticipated round a screw dislocation. Chapter II reviews the theories of crystal growth, discussing both the classical work and the dislocation theory. Here the necessary mathematical results are stated clearly without, however, burdening the reader with detailed analytical argument. Next, the methods of observing the growth patterns are described in Chapter III, and the introductory part of the book (pp. 1–97) concludes with a short chapter (IV) on the phenomenon of polytypism.

The experimental observations on spiral pyramids are described in Chapter V. The treatment includes a discussion of interactions between spirals, and between growth fronts and dominated dislocations. The analysis of interlacing spirals is treated in some detail, and illustrated with examples from carborundum, the normal alcohols and biotite. Growth by the formation of helicoidal depressions, first observed in the laboratories at Ghent, forms the subject of Chapter VI. Here it is interesting that similar phenomena occur (in salol and thymol), both during growth from solution and from the melt. In this connexion, an investigation of the familiar 'hopper-type' crystals sometimes obtained in specimens of cast bismuth might be interesting. Chapters VII and VIII deal respectively with the relation between etch pits and dislocations, and the evidence obtained about individual dislocation movements from the study of helicoidal pits and hills. Finally, in a short concluding chapter, the authors sketch some of the problems and proposals about the origin of the dislocations causing the growth, and mention briefly the extraordinary phenomenon of 'whisker-growth', where thin filaments with mechanical properties approximating to those attributed by theory to the 'perfect' crystal are obtained.

The book is illustrated with many clear diagrams, and 57 excellent photographs which show on real crystals nearly all the phenomena discussed in the text. A minor blemish in these photographs is that there has been some confusion in their numbering; they make their point so well, however, that the reader is in no difficulty in rearranging them correctly.

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Reference

VERMA, A. R. (1953). *Crystal Growth and Dislocations*. London: Butterworth. (See *Acta Cryst.* (1954), **7**, 224.)