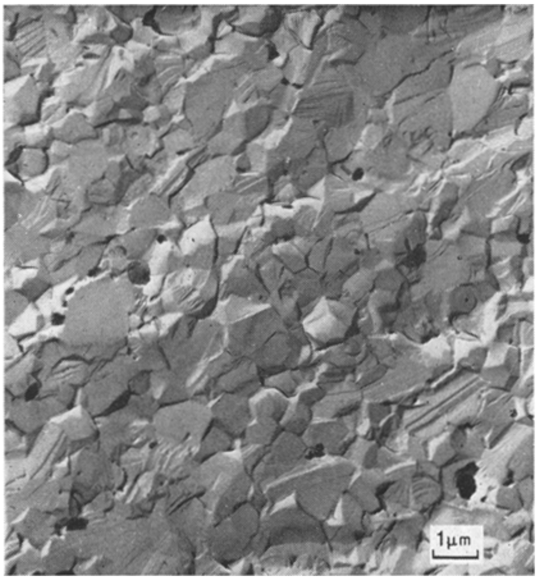

Figure 3 Electron fractograph of hot-pressed Sc_2O_3.

mined by attaching SR-4 strain gauges (type FAP-06-12) to the tensile surface of the bend bars. From data gathered, thus far, the elastic modulus for hot pressed Sc_2O_3 was calculated as 24600 Kg/mm^2 and modulus of rupture values were 21.8 Kg/mm^2.

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The Observation of Helical Dislocations in Sapphire

During the course of investigation of dislocations in sapphire crystals [1], numerous dislocation reaction of the type:

$$[2\bar{1}\bar{1}0] + [\bar{1}2\bar{1}0] + [\bar{1}\bar{1}20] = 0$$

were identified. Each reaction represents a self-pinning point, hence the dislocations involved cannot glide easily. However, a special kind of controlled dislocation climb can take place. If a straight dislocation of predominantly screw character, and pinned on both ends, could climb, it would curve and thereby acquire an edge type component. This type of climb would require a transfer of material and a high activation energy, hence, the implication is that the dislocation will be active only at an elevated temperature. Provided that the climb already described could be accomplished, then prismatic glide [2] parallel to the Burgers vector can occur, as well. In such a case, a dislocation which is pinned on both ends and undergoes limited climb and prismatic glide would curl, and, under certain circumstances, may result in the formation of a helicoidal dislocation. Such helical or helicoidal dislocations have been observed, using decoration techniques, in ionic crystals such as CaF_2 [3-6] and NaCl [7, 8]. A review of the subject of dislocations in ionic crystals in which the mechanism describing the formation of these helices is given by Amelinckx [9].

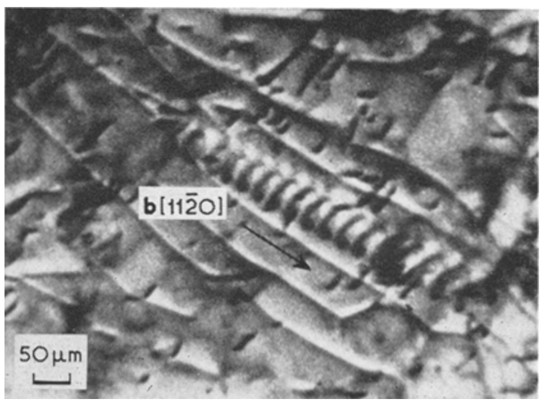

Figure 1 An X-ray transmission topograph of a sapphire plate, cut parallel to the (0001) plane, taken in $\bar{3}030$ reflection. The arrow indicates the direction of the Burgers vector with respect to the helical dislocation. This helical dislocation exhibits total extinction in $\bar{3}300$ reflection.

This is the first time that such a helical dislocation has been observed in sapphire (see fig. 1). The examination of helices in sapphire, displayed by stereo topographs, revealed that the axes of the helical dislocations are parallel with basal plane and in the $\langle 2\bar{1}\bar{1}0 \rangle$ directions. Consequently, such a helical dislocation will be mostly of an edge character. Therefore, for the total extinction of the helix, both conditions, $\mathbf{g}.\mathbf{b} = 0$ and $\mathbf{g}.\mathbf{n} = 0$ must be satisfied simultaneously. Since the helical dislocations are totally extinct in the topographs obtained, using the $\{30\bar{3}0\}$ diffraction planes, the Burgers vectors are parallel to the $\langle 2\bar{1}\bar{1}0 \rangle$ directions and also with the axes of the helicoidal dislocations.

In sapphire the helicoidal dislocations, having Burgers vectors directions $\langle 2\bar{1}\bar{1}0 \rangle$, were identified. It should also be noted that the formation of numerous prismatic loops, originating from the helical dislocations, are frequently observed (see fig. 2). Hence it may be inferred that the loops, such as have been observed by Lommel and Kronberg [10], could have been formed by a similar mechanism. The magnitude of the Burgers vectors was derived from the topographic study performed on sapphire [1].

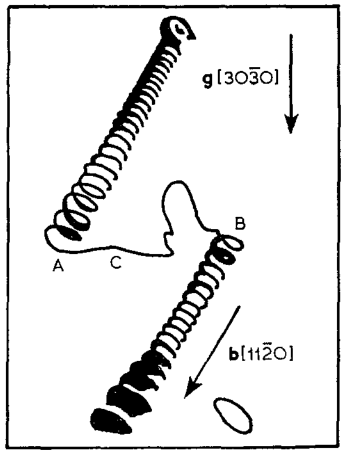

Figure 2 A schematic drawing of topograph (a) (in fig. 3) showing vectors **b** and **g** properly oriented with respect to the A and B helices. These helical dislocations are connected by dislocation C.

A detailed explanation of this work will be presented in the near future.

Acknowledgement

Thanks are extended to the National Research

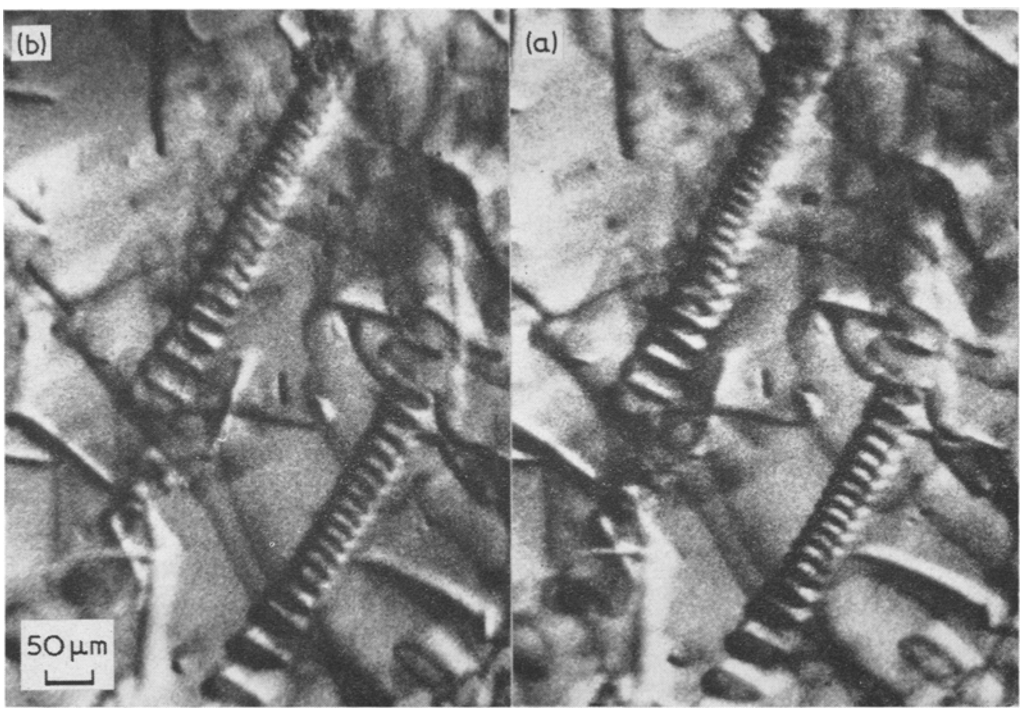

Figure 3 A stereo pair of X-ray topographs where (a) is in $30\bar{3}0$ and (b) is in $\bar{3}030$ reflection. A pair of basal, helical dislocations is shown interconnected by a dislocation line. Viewed stereographically, the helix on the right is higher than the helix on the left. Note the prismatic loop in the lower right-hand corner.

Council, National Academy of Sciences for their cooperation with the Army Materials and Mechanics Research Center in the administration of this work.

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Book Reviews

Biomedical Polymers

Edited by A. Rembaum and M. Shen

Published by Dekker £8·35

This book is an edited version of the papers presented to the Symposium on Biomedical Polymers at the California Institute of Technology in July 1969.

The book starts with an excellent paper on the effects of intervention on the blood-fluid itself and on blood tissue reactions. This is followed by one on artificial kidney treatment where the need is shown for a small, cheap disposable dialyzer that can be operated by persons of minimum skill and training. The first four papers in Part II deal with the more technical aspects of Medical-grade polymers followed by some work on foreign-body reactions to the implanted plastics and methods of screening for compatibility. Part III is concerned with the evaluation of polymeric substances that appear to have properties that make them suitable for implantation. Particularly impressive is the careful research for carcinogenic effects which would rule out the use of any proposed implantation substance. Future developments are covered in Part IV, the final paper setting out in a very clear way the challenge that is given to polymer chemists by the Medical profession covering everything from artificial hearts to tissue adhesives.

There are very full references at the end of each paper so that the book should prove useful to researchers just entering the field, as well as to surgeons anxious to know what can and cannot be implanted with safety. For those already working in the subject the way ahead is clearly demonstrated.

G.C.S.

Optical Microscopy of Metals

R. C. Gifkins

Pitman. Pp. 208 £3·75

In the introduction to this book Dr Gifkins stresses the continuing importance of the technique of optical microscopy in the study of materials, and the need for the good metallurgist to be an excellent metallographer. It is certainly still true that a great deal of valuable information can be gained by this technique used on its own, or in parallel with modern metallographic aids such as the scanning electron microscope and microprobe analyser.

The book is written with two groups of readers in mind, the practising metallographer who wishes to learn about the specialised optical techniques now available, and the student who