Short Notice

Strengthening Methods in Crystals

Edited by A. Kelly and R. B. Nicholson

Elsevier Materials Science Series, 627 pp. £12·50

This volume seeks to review the methods of increasing the resistance to yielding, and the fracture stress of both single and polycrystalline materials. Its scope is much wider than the earlier volume written by Kelly and Nicholson (Progress in Materials Science, 1963, **10,** 151pp), and it is particularly pleasing to see the extension of the theory to deal with crystalline non-metallic materials.

The plan of the book follows an orderly sequence, starting with a very detailed treatment of the subject of dislocation-particle interactions. A particularly important point emphasised by Brown and Ham is that the peak strength may be attained at smaller particle spacings than that predicted by dislocation looping when the reaction involves precipitate cutting by two dislocations (e.g. two particles coupled by a stacking fault).

In chapter 3, M. F. Ashby deals with the deformation of multiphase alloys in which one phase has a higher yield stress than the other. It is suggested that the arrangement of the dislocations in the gradients of deformation set up within the material controls the local yield stress, this gives rise to the concept of the geometric slip distance (λ_G). Ashby predicts that this parameter will enable a general plasticity theory based on dislocation mechanics to be developed for these materials.

The next four chapters then discuss the effect which different microstructures have upon the strength of materials, including, (i) intermetallic compounds and other ordered phases; (ii) martensitic and other shear reactions; (iii) dislocation substructures associated with very fine grained materials (below 5 μm) and (iv) precipitation hardened ceramics, in which G. W. Groves suggests that not only are large volume fractions of ductile particles required to raise the crack propagation resistance, but the particles should be larger than 10 μm. A further chapter by Kelly deals with fibre-reinforced materials and includes an excellent review of the fatigue and creep resistance of these materials. Chapters 9 and 10 discuss the production of materials which possess an inherently strong microstructure: those produced from the liquid, e.g. fibrous structure obtained from eutectic solidification, and those produced by solid state treatments, e.g. high densities of dislocations and precipitates obtained by thermomechanical treatments.

The final chapter is an excellent summary by the editors of the present understanding of the subject and the ways in which further developments of strong materials could take place.

This book will be an extremely valuable addition to the personal collection of any worker in metallurgy and materials science and particularly those interested in the relationship between strength and microstructure. The only disappointing feature of this work is the very sparse index, one has to hunt about quite a lot to find specific information, particularly if it is distributed in several chapters.

R.A.F.