

proved to have too little in common to force such a union.

In this book a definite attempt is made to bring them together, and six of its chapters deal specifically with solids, metals and dislocations. One gets the impression that where the plasticity of solids can be dealt with from a macroscopic standpoint, as in the articles by Prager, Drucker, and Dow, there is a good chance of linking it to the formal part of rheology, such as is described in the article by Reiner; but that, as soon as the molecular processes of slip in crystals enter the discussion, as in the articles by Dienes, Fleeman, and J. M. & W. G. Burgers, it begins to look like a shotgun wedding. However, one is grateful to the Editor for having persuaded J. M. Burgers to write again after so many years, in a delightful and modest article with his brother, about dislocations in crystals.

Two-thirds of the book deal with the traditional topics of rheology—elasticity of rubber, non-Newtonian flow, viscosity of emulsions—in a series of articles by Rivlin, Alfrey & Gurnee, Fox, Gratch & Loshaek, Frisch & Simha, Peterkin, and Oldroyd. Two trends in this part of the book that particularly interested the reviewer are the movement away from the old formalized rheological models—the spring and dashpot models—towards a molecular theory of rheological behaviour, and the interest now taken in the elastic properties of liquids. The first is brought out particularly strongly in articles by Bondi, and by Riseman & Kirkwood; the second in an article on the acoustical properties of liquids by Lindsay.

Altogether this is a most useful book, particularly for those who wish to know how the physics of the liquid state is developing.

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Les Dislocations. By J. FRIEDEL. Pp. vii+314 with many figs. Paris: Gauthier-Villars. 1956. Price 3,500 fr., \$ 10.20; bound 3,800 fr., \$ 11.05.

Ten years ago there was no direct evidence for the existence of dislocations, and the development of the theory and its application to yield specific predictions capable of experimental verification was the concern of a small group of research workers interested primarily in metal plasticity. Today we can see the dislocations in metallic and non-metallic crystals, and fundamental experiments are increasingly concerned, not merely with the observations of the effects of dislocations, but with the study of the behaviour of the dislocations themselves, almost as this behaviour may be studied in a bubble raft. At the same time there has been a great development of the theory, which now has widespread applications outside its original concern of the plasticity and strength of metals.

This is the third book giving a general survey of the subject. Crystallographers will expect a high standard in a work associated with the name of Friedel, and they will not be disappointed in this one. Its objective is a

mise en point for the French reader of the principal properties of dislocations, and the work is, in fact, an excellent survey of the subject.

By design, Dr Friedel concentrates on aspects which are closest to practical applications; for this reason he excludes, for example, the recent mathematical work on continuous distributions of dislocations, and on their connexion with the theory of non-Riemannian spaces (subsequently related, however, to the theory of martensitic transformations). For a countryman of Elie Cartan, this exclusion was made perhaps not without regret, for Dr Friedel gives a vivid explanation of the late development of the study of dislocations: 'et si leur étude dans les cristaux s'est développée tardivement, c'est sans doute parce que leur géométrie plus difficile choque notre sens cartésien'.

Also omitted because they are still not well understood are some subjects of practical interest, such as fatigue and internal friction. It is, perhaps, unfortunate that Dr Friedel misses the work on the observation of dislocations in thin films, both directly and by Moiré patterns, but this is a measure of the rapidity with which the subject continues to develop rather than a defect in the work.

The plan of the book is to discuss in the first part the fundamental ideas of the theory and the important general properties of dislocation lines; elementary ideas; elastic theory; glide and climb; imperfect dislocations. The author includes, too, in this part a discussion of mechanical twinning, martensitic transformations and crystal growth. The second part gives an account of assemblies of dislocations; dislocation networks and mosaic structures; cold-work and piled-up dislocation groups; recovery; polygonisation; recrystallisation; crystal boundaries; creep; cleavage. Finally, in the third part, the interaction of dislocations with other defects and structural perturbations is considered. A general chapter on interactions with impurities precedes applications to the hardness of alloys and solid solutions, and to yield-point phenomena; and the work concludes with an account of interactions with X-rays, and of optical, electrical and magnetic effects. There are four Appendices: a summary of elasticity theory (rather condensed, perhaps, so that it is more mnemonic than didactic); tables of some useful physical properties; tables of glide and twinning elements; and, most welcome, a short Franco-German-English dictionary of dislocation jargon.

Despite the author's modest claim in the preface, there is much that is fresh and stimulating in the work. He includes, for instance, a thorough discussion of dislocation climb (and applications to recovery and creep) which it is most useful to see presented as a collective whole, and he introduces some novel ideas and extensions of the theory in his discussions of cleavage, of interactions with solute atoms, and of imperfect dislocations.

The price, unfortunately, is rather high.

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