

---

 BOOK REVIEWS
 

---

**Dislocations in Crystals.** *International Series in Pure and Applied Physics.* By W. T. READ, JR., Bell Telephone Laboratories, Murray Hill, New Jersey. McGraw-Hill Book Company, Inc., 330 West 42nd Street, New York 36, New York, 1953. xvii + 228 pp. 16.5 × 23.5 cm. Price, \$5.00.

The science of solids has been blessed with two new books on dislocation theory during the past year. Both are by outstanding contributors to the field. One, being reviewed here, is by W. T. Read of the Bell Telephone Laboratories, most prominently known otherwise for his contribution to the Frank-Read mechanism of dislocation multiplication. The other is by A. H. Cottrell of the University of Birmingham, responsible among other things for the dislocation-locking theory of the upper yield point in steel. It is highly appropriate that either or both these men should decide to write a book at this time for the field has not been reviewed in such form for nearly a decade. The only substitutes are the reports summarizing the conferences held in Bristol in 1947 and Pittsburgh in 1949, and Nabarro's review article in "Advances in Physics" in 1951.

The book by Cottrell, which bears the title, "Dislocations and Plastic Flow in Crystals" (Oxford University Press), would be somewhat easier to review than the present volume, for it fits into a very well developed pattern. Cottrell's intent is to be as comprehensive as he can within the number of pages he has decided to cover. His book has enormous value because it serves to consolidate the relatively diverse subject, its hundreds of footnote references alone being of importance. Moreover, much attention is paid to historical perspective and to the probable future course of the rapidly developing subject.

Read's book is somewhat more specialized and is, as a result, apt to have slightly more limited interest. It is in a sense a detailed re-working, with extensions, of material close to his own contributions to dislocation theory. The contributions of others are included, in the main, when parallel to or basic to his own. This does not mean that the book will not be exceedingly valuable. Read and Shockley have made some of the most gallant attempts in the last decade to carry out quantitative calculations with arrays of dislocations. Any graduate student who is interested in engaging in this type of research will find the book very useful. For example, he will find analyzed in a simple and detailed way the forces which act upon a dislocation in a region of a solid which is under external stress. He will find a continuous development from such notions to those dealing with the behavior of arrays of dislocations, particularly the arrays associated with a grain boundary on which Read and Shockley have made a fundamental contribution.

One of the characteristic features of the volume, which indicates that the author's goal is the moulding of the young mind, is the inclusion of much of the basic materials in problems of a text-book variety which the reader is expected to work as he goes along. The solving of these problems will aid him in developing proficiency in the handling of the tools and techniques associated with computational aspects of the subject. This procedure, which has great value for the young student, will probably make the book less valuable for the mature research worker in another field who desires to obtain a general picture of the status of dislocation theory.

There is one point of philosophy on which I would like to cross swords with Read. In the introductory chapter, Read states, "What is definitely known about dislocations is distinguished from what is speculated; the latter is given little attention here (it is more than adequately covered in the literature)." Any author has the privilege of limiting his subject matter as he desires. Read has decided to limit his book to areas in which he has made explicit calculations and he has made an excellent contribution within this framework. On the other hand, I do not believe that dislocation theory has yet reached a stage where one can state that the available literature is over-rich in speculation. There is still an enormous number of very fundamental problems concerning dislocations which we understand only dimly,

such as those related to the dynamics of motion, those related to the way in which dislocations generate other imperfections such as vacancies and interstitial atoms, and those related to the connection between dislocations and photolysis in the salts. It is possible that one will reach an understanding of these issues through routine calculation of an engineering variety; however, it is far more likely that they will be solved only as a result of ingenious experiments based upon highly speculative notions. It is hardly necessary to point out that our present understanding of dislocations has been derived primarily by this process. When T. A. Read and the writer attempted the first systematic survey of dislocation theory in the American literature in 1940 (*Journal of Applied Physics*), the subject was almost pure speculation. I do not believe it would have reached its present position without such speculation, nor do I believe it will progress further if fairly free speculation is regarded as superfluous from this point onward.

To turn to the contents of the book, in contrast with its philosophy, the volume is divided into two main parts, one dealing with theory and the other with applications. The part on theory, which occupies two-thirds of the volume, starts with a discussion of the contrast between the perfect and the imperfect crystal, viewed from the standpoint of lattice geometry, describes the geometry of dislocations at rest and the change in geometry induced by motion. Next, the effect of applied forces on the motion of dislocations is treated and questions concerning ease of motion of various dislocations are discussed. Following this, the problem of dislocation generation, on which Read has been one of the principal contributors, is reviewed and this is followed by chapters on partial dislocations, the stress field around dislocations and forces between dislocations. In all of this, Read sticks very close to the aspects of the topic which he has worked on personally, or in cooperation with Shockley. For this reason, some of the chapters are much briefer than need be the case. For example, there is no discussion in the sections dealing with forces between dislocations of some of the elegant theorems concerning lines of dislocations lying in the slip plane which were developed by Cottrell, Eshelby, Frank and Nabarro.

The section on applications focuses attention on two major problems, namely, that of crystal growth, where Frank's theory is developed and the cases in which it has been confirmed are discussed, and that dealing with the accumulation of dislocations at grain boundaries, the latter being a problem on which Read and Shockley have made an outstanding definitive contribution.

The book is profusely illustrated with schematic line drawings, which illustrate many of the conceptions presented.

In conclusion, it may be stated that this is a specialized book written to expound the relatively pragmatic view of a single investigator, who has placed emphasis on an important group of problems. Unquestionably it belongs on the shelves of anyone who is interested in undertaking detailed calculations with dislocation models. It probably has somewhat limited use for the individual interested in broad applications of dislocation theory or for those who desire something approaching a general review of the subject. Such readers would find Cottrell's book more nearly appropriate.

UNIVERSITY OF ILLINOIS  
URBANA, ILLINOIS

FREDERICK SEITZ

---

**Electrochemical Constants.** Proceedings of the NBS Semi-centennial Symposium on Electrochemical Constants Held at the NBS on September 19-21, 1951. By National Bureau of Standards. Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., 1953. iv + 310 pp. 16 × 23.5 cm. Price, \$2.00.

Of the 30 papers presented at the symposium and published in this volume, 27 are given in full, including the ensuing discussions, and 3 are in abstract form. They contain results of original work as well as review material by eminent experts in theoretical and experimental electro-