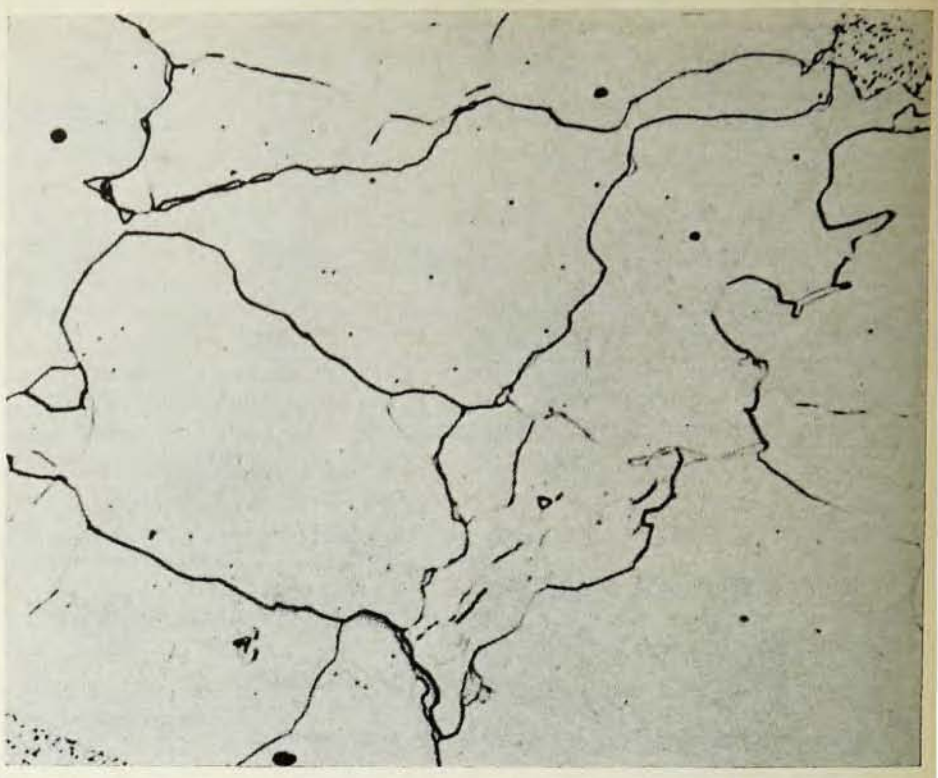

GRAIN BOUNDARY MIGRATION during creep of a carbon steel at 593°C under stress of 4000 psi. Micrograph 350X. (Photo courtesy U.S. Steel Corporation.) From *Fundamentals of Creep and Creep-Rupture in Metals.*

is possible, and the author has probably performed a service in working one out and presenting it, if only to exhibit the difficulties involved. Whether the new treatment will prove sufficiently advantageous to replace the old remains to be seen. For one thing, as is stated at the end of the preface, the new treatment does not remove the necessity for students of physics and engineering to understand and use complex numbers.

For another, the treatment is not short; the present exposition takes some 120 pages and is bedecked with 167 problems. Finally, although this new approach is apparently intended for teaching to students of physics and engineering, the author gives no hint that it has ever been tried out on a class. Favorable evidence from such a field trial would give much more weight to these new proposals. Pasteur's way of promoting the acceptance of a new idea remains the best.

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Metallic fracture

FUNDAMENTALS OF CREEP AND CREEP-RUPTURE IN METALS. By Frank Garofalo. 258 pp. Macmillan, New York, 1965, paper $4.50.

by Daniel B. Butrymowicz

Fundamentals of Creep and Creep-Rupture in Metals is one of the initial titles in the MacMillan Series in Materials Science—a series that attempts to provide low-cost textbooks in a wide range of topics in materials science. The author, well known for his many contributions in this area of metallurgy, has endeavored to gather, correlate and then systematically present much of the published data dealing with the fundamental aspects of creep and creep-rupture behavior of metals and alloys. At present, this being one of the more active fields of metallurgy, there is a genuine need for a review such as Garofalo's.

Intended as a textbook and reference source, the volume contains an introductory chapter supplying definitions and descriptions of deformation, creep, and creep-rupture. The next four chapters are concerned with the

phenomenological viewpoint of creep in metals and alloys, basing the discussion on experimental results. Time dependence of creep deformation; stress relaxation; strain recovery; the effect on the creep curve of grain size, of alloying environment, and of mechanical-thermal treatments; and experimental observations on the stress dependence of creep are covered. The temperature dependence of creep and the apparent activation energy for creep are given over to another chapter. The modes of deformation are described and an effort is made to relate them to creep-controlling processes and creep strength.

A separate chapter exposes the reader to a host of theories, among which are transient creep theories, steady state creep theories, theories of grain boundary sliding, etc. Included are the currently most popular theories based on dislocation motion, as well as others which have gained little acceptance. The final chapter discusses creep-rupture, its relation to creep deformation, the nucleation and growth of cavities at grain boundaries, and the mechanisms of intergranular fracture.

Throughout the book discussion is limited to deformations produced by simple tensile, compressive, or shearing forces; deformations produced by complex states of stress receive little comment. The author has reviewed the literature exceedingly well and the data are unbiasedly reported. His writing is intelligible and concise and supplemented with considerable data and occasional schematic diagrams and micrographs. Additionally, the bibliographic collection should make the book decidedly useful as a reference volume. Periodic revisions to keep abreast of future developments will maintain the value of the book.

If one were to find fault with this contribution of Garofalo's, it would be the absence of his critical and authoritative comments on some of the subject matter. Some readers will question the utility of the alphabetically arranged references since the book lacks an author index and the two-page subject index is all too brief for the wealth of material contained therein. However, these admittedly are very minor faults and detract little from the book's worth when one considers it as a whole. This paperback is a creditable addition to the metallurgical literature and is recommended reading for the metallurgist and solid state scientist.

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The reviewer is a metal physicist with the metallurgy division of the National Bureau of Standards in Washington.

Theory and Practice

FUNDAMENTALS OF SEMICONDUCTOR DEVICES. By Joseph Lindmayer and Charles Y. Wrigley. 486 pp. Van Nostrand, Princeton, N. J., 1965. $11.95.

by H. J. Hagger

A great number of books have been and will be published whose titles state that they deal with "fundamentals." Different people mean quite different things when they use this word. In most cases such a book could have been published under the title "Basic Principles of . . . ", but not the book by Lindmayer and Wrigley. The authors have succeeded in writing a text joining solid-state physics and electronics and explaining the operation of semiconductor devices, including even the most modern designs.

Chapter 1 is a very short qualitative discussion of semiconductor properties. It just contains the minimum understanding for most modern and future semiconductor work. In chapter 2 on semiconductor junctions and in chapter 3 on transistors the reader enters the primary field of solid-state electronics and learns gradually the reasons for the electrical behavior of junctions, their low- and high-frequency characteristics, equivalent circuits, etc. Chapter 4 is on inhomogeneous impurity distributions, which lead to transistors with better performance than the homogeneously doped devices explained in chapter 3. The properties of inhomogeneously doped crystals enable one to manufacture drift, mesa and planar transistors. A very helpful table compares the transistor param-

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H. J. Hagger, who is associated with Albiswerk/Zürich, is a specialist in electricity and electronics.