BOOK REVIEWS

Selection of books for review is based on the editors' opinions regarding possible reader interest and on the availability of the book to the editors. Occasional selections may include books on topics somewhat peripheral to the subject matter ordinarily considered acceptable.

PATIENCE REWARDED

Title Strength and Structure of Engineering Materials

Authors N. H. Polakowski and E. J. Ripling

Publisher Prentice-Hall, Inc., 1964

Pages xviii + 535

Price $17.35

Reviewer P. H. McDonald

This book is a rather complete anthology of the general field of mechanical behavior of solid materials. Perhaps its greatest value will be its service to engineers who do not specialize in the subject, but who have need of a source of ready reference to the essential features of the field.

Its value is enhanced by the inclusion of many of the most up-to-date aspects of the relevant literature. It closely follows the contemporary trends in research.

The book should be read by engineering educators also, primarily because it epitomizes the struggle of teachers who seek a new synthesis of the engineering science areas in the curriculum. It brings to a sharp focus the essential difficulties of an effective integration of the principles of mechanics with the properties of solids.

A central and massive weakness of the text is its limitation to the nondynamical realm of behavior. This stems from the fact that inertial effects cannot be provided for unless equations of motion are written. The authors have apparently rejected the basic principles of mechanics as outside the scope of their writing, while at the same time they have drawn heavily upon the results of force balance, momentum balance, and energy balance laws. The general boundary value problem of solid objects is nowhere raised. This stands in sharp contrast to the treatment of the fundamentals of materials structure (cf the sections on "Elements of Crystallography," pp. 72-82, et seq.), which is very basic and deals with primitive concepts.

In one sense, the volume seems quite laminated. That is, a particular subject will, without any apparent connectivity, be interleaved between other topics which form a contiguous grouping. A good example of this is Chapter 12, *Hardness*, which is immediately preceeded by chapters on *Tensile* and *Compressive Properties*, and is followed by chapters on *Bending* and *Torsion* and *Shear*.

In another fashion, the text oscillates between the macro- and micro-realms. This is particularly the case during the first seven chapters, but, as the authors correctly point out in the Preface, the gap between these two domains has yet to be satisfactorily bridged.

However, the reader who wishes to acquire a first-level acquaintance with the broad realm of solid materials properties will, with some patience, find a reference to most topics somewhere in this book. He will also find suitable references to more extensive work in the various areas of the subject.

P. H. McDonald is Harrelson Professor and Head of Engineering Mechanics at North Carolina State University, Raleigh, where he received the BS degree in 1947; his MS and PhD are from Northwestern University (1951 and 1953). He taught mechanics and hydraulics at Clemson University and, since 1953, has taught these subjects at North Carolina State. His research has featured projects in impact and shock resistance of plastics, vibratory compaction of granular media, lubrication behavior of liquid metals, vibration of nonlinear systems, contact stresses, and dynamics and thermodynamics of viscoelastic media.

SOME ASPECTS OF CARBON IN DEPTH

Title Chemistry and Physics of Carbon, Volume I

Editor Philip L. Walker, Jr.

Publisher Marcel Dekker, Inc , 1966

Pages xv + 382

Price $13.75

Reviewer William E. Parker

This is the first volume of a series of somewhat all-inclusive "recent advances" in the subject. Its format comprises a series of papers, written by experts, each concerned with a rather narrow aspect of carbon technology. Judging by the contents of Vols. I and II (titles listed in Vol. I), these monographs will not constitute a general text on carbon but may well serve as a conven-

iently compiled encyclopedia of special topics in the field. The unavoidable variation in writing style between papers is a minor annoyance, but the illustrations, indexing, and editing have been well done.

The chapter on dislocations and stacking faults in graphite very thoroughly describes these phenomena and their causes. However, it is obviously not written to be a first exposure to the subject. A prior knowledge of general crystallographic principles and an understanding of the terminology of the specialization are prerequisites for comprehension of the subject as presented.

Inversely, the section on gaseous transport within graphite presupposes no prior exposure to the subject and starts with basic principles. The complexity of diffusion and permeability relationships in graphite is described and experimental techniques are critically evaluated. This paper offers a good introduction and lengthy reference list to those who wish to delve more deeply.

The chapters on the reactions of oxygen-bearing gases with graphite are also somewhat contrasting in content. After an overly long treatment of the formation and observation of dislocations and etch pits, which will be chiefly of interest to microscopists, reactions of molecular and atomic oxygen, alone and in the presence of various catalysts, are concisely discussed. Reactions of carbon dioxide and steam with carbon are given rigorous treatment in a well-organized, very well presented exposition.

The section describing the formation of carbon from gases is that rare gem; a critical and comprehensive evaluation of the literature by acknowledged experts, lucidly and thoughtfully presented. It should be required reading for those with even a peripheral interest in the subject, and will be of value to all workers in the field.

The last chapter describes a method for measurement of thermoelectric power of graphite and relates the use of such measurements to studies of chemisorption of oxygen on graphite surfaces. Although highly specialized and not of general interest to workers in other phases of carbon science, the treatment is thorough and rigorous with respect to the underlying mathematics and physics.

In substance, this book, and probably the series, should be a useful reference for scientists working in and around the physics and chemistry of carbon. It is not recommended for the generalist who desires a broad overlook of the field.

William E. Parker joined the Research Department of Speer Carbon Company, Division of Air Reduction Company, Inc., in 1959, after obtaining degrees in chemistry from Brown University (ScB) and the University of Kansas (PhD) and working several years in the nuclear industry. He has been associated with various phases of carbon and graphite technology, and has published extensively in the field. He is currently Director of Research at Speer.

QUANTITATIVE AND CORRECT

Title Introduction to Special Relativity

Author James H. Smith

Publisher W. A. Benjamin, Inc.

Pages xii + 218

Price $6.00 (clothbound), $2.95 (paperback)

Reviewer John G. Fox

This readable little book is well suited for study by those who wish to acquire "a real working knowledge at an elementary level" of special relativity. That is the author's hope and my belief. It is designed for use as a textbook for physics majors following one semester of freshman mechanics. Pitched at this level, and with its unusually full discussion of concepts, this book should enable almost any technically trained person to become acquainted with special relativity.

The first half of the book is a treatment of fundamental ideas, replete with examples and thought experiments. After introductory remarks on the relativity postulate, with illustrations from ordinary mechanics, there is a discussion of wave motion, light, and the Michelson-Morley experiment—always starting from the most elementary ideas—and the experimental basis for the constancy of the speed of light. The latter is somewhat incomplete, through no fault of the author's, since several papers on this subject appeared while the manuscript was in preparation and production. One might wish that more space had been devoted to the monumental, but unsuccessful, effort of Ritz to save classical kinematics by developing an emission theory of electromagnetism. But this is a matter of taste, and I am perhaps biased. However, it is not correct to say that "if light were a stream of mechanical particles" it could not have wave properties: the stream of water from the nozzle of a garden hose has no trouble assuming wave properties if one jiggles the nozzle. After discussing the speed of light, the author treats such topics as time dilation, length contraction velocity addition, aberration, and the Doppler effect. The discussion, while quantitative and correct, is always full and physical rather than formal. This part of the book ends with an unusually lengthy treatment of the famous twin paradox which, while it has no connection with experiment now or in the forseeable future, always has a special fascination for both layman and professional.

The second half of the book is slightly more formal than the first because it develops some of the analytical tools needed to make calculations for the scattering of elementary particles, nuclear reactions, etc. It will amply repay careful study by anyone who really wants to obtain some *working* knowledge of the subject. First, of course, comes the Lorentz transformation which actually has already been derived unbeknownst to the beginner. Relativistic momentum and energy are defined, and their conservation demonstrated. The center of mass transformation and the notion of four-vectors are introduced and carefully discussed; their usefulness is illustrated by many sample calculations. In the last chapter the author discusses electromagnetic forces and the transformation of the electromagnetic field. This cannot really be left out of a book on special relativity, since this is where the revolution began over 60 years ago. However, the author is probably right in basing his development mainly on mechanics and the Michelson-Morley experiment "on the