Book Reviews

Works intended for notice in this column should be sent direct to the Book-Review Editor (J. H. Robertson, School of Chemistry, University of Leeds, Leeds LS2 9JT, England). As far as practicable books will be reviewed in a country different from that of publication.

Deformation geometry for material scientists. By *C. N. Reid.* Pp. viii + 211, Figs. 113, Tables 11. Oxford: Pergamon Press, 1974. Price (cloth) US$12.00 (£4.80), (paper) US$7.50 (£3.00).

This book deals with the basic geometry of deformation processes. The macroscopic view prevails here over the microstructure approach which now dominates the teaching of mechanical properties of solids. The microstructure is practically ignored and the materials are considered to be homogeneous and in most cases isotropic. Dislocation theory is certainly supported by the author, especially for the microscopic description of mechanical processes. His own words are the best way of demonstrating his views and purposes: 'I do argue that dislocations have enjoyed particular emphasis in curricula, as is borne out by contemporary textbooks. On the other hand, I think that there has been no complementary emphasis on macroscopic mechanics, and this book is an attempt to redress the balance a little'.

The seven chapters of this book are: I. *Concepts of Stress and Strain*, II. *The Tensile Test*, III. *Linear Elastic Deformation*, IV. *Plastic Deformation of Isotropic Materials*, V. *The Geometry of Single and Duplex Slip*, VI. *Slip on More than Two Systems – Multiple Slip*, VII. *Plastic Deformation of Crystals by Twinning*.

The basic concepts of elastic and plastic deformation are introduced in the first four chapters. Several worked examples in every chapter help the reader to master the concepts of tensor and engineering strains, of the familiar types of stress state of anisotropic elasticity, of the geometrical criteria of tensile instability under stresses, *etc.*

The geometry of slip process due to migration of dislocations is considered in the next two chapters. The slip systems are introduced for the most common crystals. The geometrical aspects of the process: the resolved shear stress, reorientation of directions and planes by single slip and the next stages of slip – duplex slip and multiple slip are considered further. It is clear that many peculiarities of stress–strain relations depend on the geometry of deformation: sample, stress state and stage of deformation. These peculiairities for different geometries and materials are illustrated by the well selected worked examples.

The geometry of plastic deformation by twinning in crystals is the main content of the last chapter. The author considers the microscopic mechanism of twinning in some familiar crystal lattices in order to determine the twinning elements and the transformations of crystallographic directions by twinning.

The book was written for the materials science undergraduate, but the volume will be of interest not only to students, but to a much wider range of materials scientists, who deal with the mechanical testing of materials.

K. ALEXANDROV

Institute of Physics
Siberian Branch of
USSR Academy of Sciences
660036 *Krasnoyarsk*
USSR

Metals, ceramics and polymers. Par *Oliver H. Wyatt* et *David Dew-Hughes*. Pp. xi + 640, Figs. 423, Tableaux 58. Cambridge Univ. Press, 1974. Prix £12.00, (livre broché) £4.95.

Oliver H. Wyatt est Senior Principal Scientific Officer au Royal Aircraft Establishment et David Dew-Hughes est lecteur à l'Université de Lancaster. Le propos de leur livre est de fournir une introduction à la connaissance de la structure et des propriétés des matériaux solides, en s'attachant systématiquement à relier les propriétés macroscopiques aux faits structuraux et physiques microscopiques. Les étudiants en sciences des matériaux, surtout ceux qui aiment le concret, utiliseront ce traité avec un bon profit. Mais les ingénieurs y trouveront aussi une excellente source pour la mise à jour de leurs connaissances, et, dans une large mesure, un ouvrage de référence, grâce aux très nombreux tableaux de données numériques qui complètent heureusement le texte.

Les premiers chapitres sont consacrés à l'exposé des bases: structure atomique, structure cristalline, structure électronique des cristaux. Le chapitre sur la structure cristalline n'est pas très original dans la présentation. Il constate plus qu'il ne justifie: les cristallographes auraient aimé sans doute qu'un effort soit fait de ce côté. Vient ensuite un exposé détaillé des diagrammes d'équilibres, binaires et ternaires. De nombreux exemples rendent agréablement digest une matière qui ne l'est pas toujours dans les traités classiques.

L'étude des propriétés mécaniques est ensuite abordée avec un chapitre de présentation d'ensemble et deux chapitres sur la plasticité, l'un traitant de la théorie macroscopique, l'autre de la physique de la plasticité. Ce dernier est d'ailleurs habilement placé après deux monographies consacrées respectivement, l'un aux céramiques et aux verres, l'autre aux hauts-polymères. Ces deux monographies m'ont paru être de très bonne qualité: elles présentent les choses avec une grande clarté.

La physique de la fracture et les méthodes qui permettent de durcir les matériaux sont exposées en détail, et avant de passer aux propriétés magnétiques et électriques des solides, les auteurs consacrent un chapitre au système fer–carbone, avec, en particulier, un bon développement sur les traitements de l'acier.

L'étude des propriétés électriques est divisée en deux parties: métaux d'une part, semi-conducteurs et isolants d'autre part. On y trouve l'essentiel, et même un développement intéressant sur la supraconductivité. Le dernier chapitre traite du magnétisme des solides. Il est axé sur les métaux et alliages et reste très discret sur les nouveaux types de matériaux magnétiques.

Au total, c'est un bon livre qui nous est présenté. Réaliste et solide sur ses bases, sans prétention inutile, mais avec le souci de l'exactitude et de l'efficacité. Un ingénieur qui aurait assimilé la matière de ce traité serait bien apte à aborder la très grande majorité des problèmes que peut poser la science et la technique des matériaux.

H. CURIEN

Laboratoire de
Minéralogie-Cristallographie
Faculté des Sciences de Paris
Tour 16
9 *Quai St. Bernard*
Paris 5
France

Electron microprobe analysis. By *S. J. B. Reed.* Pp. xvi + 400, Figs. 167, Tables 25; plates 8. Cambridge Univ. Press. 1975. Price £12.00.

After a decade of intense development in theory, intrumentation and practice, elec-

tron-probe microanalysis has now become a routine analytical procedure and, insofar as future events can be predicted, no major developments seem to be around the corner. The appearance of an authoritative, up-to-date and fairly extensive treatise on the subject is therefore well timed.

Reed's book is not the first one on this subject. Among those still of general usefulness are the ones by Birks (1971) and Andersen (1973). Birks's book is a concise and mainly descriptive introduction into the subject, recommendable to the beginner or the scientist or student seeking an overview of electron probe microanalysis. *Microprobe Analysis*, edited by Andersen, is a compilation of chapters written by various authors who are experts in their respective fields. Such a format provides a selection of topics rather than complete coverage. Other publications (Heinrich, 1968; Salter, 1970; Hall, Ecklin & Kaufmann), deal with partial aspects of electron probe microanalysis.

S. J. B. Reed has apported valuable and widely used contributions to the art of microanalysis. His book reflects his long experience in the field, and it will serve very satisfactorily as a textbook for the analyst performing electron probe microanalysis or using the lithium-drifted detector in conjunction with scanning electron microscopy. The principles of instrumentation and operation, the theory of quantification and the analysis of thin films are extensively and rigorously treated. The level of the text is uniformly high and eminently readable. In the application section, the author discusses a small but representative sampling of practical analyses.

The disagreements I may have with the author are mostly of detail – such as to his doubts on the efficacy of the hyperbolic iteration for multielement specimens (p. 294), or concerning the use of an atomic number effect in the absorption correction (p. 252). A more serious objection is that the computer programming, though 'practically essential for matrix corrections ...' (p. 296) is not discussed in sufficient detail. Manual correction calculations are impractical for all but the most casual users of the microanalyzer, and the problems arising from the use of a program which is not fully understood by the analyst are obvious.

Overall, Reed's book is a valuable source of information to the microanalyst, and it deserves a place on the shelf of all scientists who make use, directly or indirectly, of electron probe microanalysis.

K. F. J. HEINRICH

National Bureau of Standards
Washington
D.C. 20234
U.S.A.

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Advances in X-ray analysis. Vol. 18. Edited by *W. L. Pickles, C. S. Barrett, J. B. Newkirk* and *C. O. Ruud*. Pp. xix + 642. New York: Plenum, 1975. Price $46.90.

In recent years we have all been made aware of a world shortage of raw materials and immediately usable energy, a crisis which increasingly threatens modern society's mode of existence. With this daunting prospect in mind, the subject emphasis for the 23rd Annual Conference on Applications of X-Ray Analysis, held at Denver in August 1974, was appropriately 'The Application of X-ray Technology to Current Problems in Energy and Resource Development'. The latest volume in *Advances in X-ray Analysis* consists of some fifty papers read at this conference on a wide variety of topics.

In the currently fashionable field of plasma diagnostics, of direct relevance to power generation by a fusion process, measurement of soft X-ray emission from high-temperature plasmas is capable of yielding information about its condition and provides a method of determining plasma parameters. Several papers in the current volume report on this field of interest and cover areas such as spectrometers for investigating shortlived plasmas together with other relevant instrumentation.

On the subject of quantitative X-ray spectrometry several papers are directed towards mathematical correction procedures. With the increasing availability of small on-line computers to facilitate data handling the determination of inter-element correction constants, either based on experimental data or theoretically derived, continues to attract attention. Analyses of geological samples, for example, are reported and one is impressed by the accuracy of determination of constituents currently attainable.

As a measure of the diversity of interests represented at the 23rd Conference one might randomly select papers devoted to the analysis of infected blood, the generation of high-intensity monochromatic X-rays, and aerosol analysis – in addition to the more usual characterization of solid materials. It is of course impossible to do justice to such a wide range of papers and merely a representative few have been mentioned briefly in this review. The overall standard of the contributions is remarkably high and serves to emphasize the expanding interest in X-ray analytical techniques.

One hopes that the aims of this Conference will be achieved and at least a partial solution found to the materials and energy crisis.

G. A. COX

Department of Physics
University of York
Heslington
York YO1 5DD
England

Quantitative scanning electron microscopy. Edited by *D. B. Holt, M. D. Muir, P. R. Grant* and *I. M. Boswarva*. Pp. x + 570, Figs. 302, Tables 25. London: Academic Press, 1975. Price £15.50.

The book contains sixteen independent review chapters but the attempt has been made by the Editors to produce a comprehensive coverage of scanning electron microscopy and its applications in both reflexion (SEM) and transmission (STEM) modes. The bulk of the book is concerned with SEM although three articles touch on the high-resolution STEM introduced by Crewe.

In respect of STEM, Howie invokes the reciprocity theorem for elastic scattering to describe the similarities between the STEM and the conventional transmission electron microscope (CTEM) and points