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Book news

1. Book review

● *Fundamentals of fracture mechanics,* by J.F. Knott. London, Butterworths, 1981 (reprint).

Reviewer: G. Leadbeater

The present reviewer approached the above book as a relative novice on the intricate details of fracture mechanics. Thus, the review is based to a great extent on how easily the information presented can be assimilated and understood, and how the book's format and content facilitate this. Note was taken of the preface comments about jumping ahead, in chapters, to ease understanding, and this was found to be a common occurrence.

The book is stated to be primarily aimed at metallurgists and engineers, and it attempts to tie together the principles of both disciplines on the subject of fracture mechanics. It consists of nine chapters.

The first chapter provides a concise description of the design engineer's viewpoint of how structures and materials fail, and such terms as *plastic design* and *plastic collapse* are defined. The significance of yield in design considerations is emphasized.

The concept of brittle failure is presented as the unstable propagation of a crack, usually due to a stress lower than that which would cause yielding. Thus, the study of stress concentrators and, consequently, the subject of fracture mechanics are introduced.

Chapters two and three deal with theoretical analyses of stress concentration and distribution around cracks in materials and structures. As a result, the information presented is predominantly mathematical and requires a sound knowledge of engineering mathematics to be fully understood.

Chapter four describes the origins of fracture-mechanics analysis from an atomic scale through the application of the basic principles of mechanics and thermodynamics. The chapter is confined to linear elastic-fracture mechanics (LEFM), and gives concise illustrations of the derivations of important parameters, e.g. stress intensity factors.

The practical application of fracture-mechanics principles is given in chapter five, where the reader acquires an appreciation of the value, and limitations, of LEFM analysis. The effects of member thickness and plastic-zone configuration are well described, leading on to recommended procedures (with theoretical base) for fracture-toughness testing.

The terms associated with elastic–plastic fracture mechanics such as crack opening displacement are introduced in chapter six. Definitions and development principles are documented, again requiring some mathematical analysis. However, the reader emerges with a sound knowledge of these specific parameters, and how essential they are for practical laboratory testing.

Chapter seven basically looks at how fracture mechanics can be applied to the ductile–brittle transition temperature phenomenon observed in BCC materials, and how this can be defined by the testing of notched samples. Further, the sources of atomic-scale defects in crystals are described in a qualitative manner. Analytical models and practical illustrations are used to specify the micromechanisms of the brittle–ductile transition in chapter eight.

The final chapter details the application of fracture-mechanics principles to fatigue and stress corrosion, with particular emphasis on the former. A less-quantitative approach is employed here, and more use is made of practical examples.

To summarize, then, the book fulfils all the intentions implied by the title and stated in the preface notes. However, if the reader expects to finish the text with a basic grounding of fracture mechanics, he or she may feel a little perplexed. Rather, a knowledge of the basics, probably gained from a more general textbook, is advisable before exploring the intricacies of this book. Thus, the book will probably be most appreciated when used for reference to in-depth analyses, where other texts merely skim the surface of the subject. For the experienced experimentalist the book is no doubt essential.

The format of the book is functional, including very comprehensive contents and index pages. The diagrams are precise, and the reproduction of the photographs in situations where practical examples are presented is more than adequate.

2. New publications

● *Mechanical testing.* London, The Institute of Metals, 1988. 357 pp. £25.

This is the third monograph available in the series en-

titled 'Characterisation of High Temperature Materials'. The aim of the Monograph is to provide a broad practical overview of modern methods for the characterization of high-temperature materials, and covers tensile testing, creep, fatigue-crack growth, low-cycle (high-strain) fatigue, high-cycle fatigue, and fracture-toughness testing.

Many of these areas have developed greatly within recent years, and the methods of testing and analysis are still being actively developed. The aim throughout is to allow the non-specialist to appreciate what types of test are available, to help select the most appropriate for his requirements, and to appreciate the manner in which the published data have been produced and analysed for presentation.

With the current emphasis throughout industry on quality assurance, there is substantial interest at present in testing methods, including the development of British and international standards. The Monograph therefore also investigates the developments in these standards.

● *Mining potential in northern and southern Canada: Guidelines for regional development policy,* by Leo J. Verleun and Brian W. Mackenzie. Centre for Resource Studies (Queen's University, Kingston, Canada K7L 3N6), 1988. 225 pp, $20.

The study examines the wide-held premise that 'more remote' means 'less economic' for mineral exploration and development. The economic analysis and comparison of mining potential between northern and southern Canada utilizes extensive exploration expenditure and mineral-deposit data relating to the base-metal sector, assembled and updated on a continuing basis at the Centre for Resource Studies since 1975.

The main conclusion is that the economic potential for base-metal exploration and development in the Yukon and Northwest Territories is significantly more attractive than in the provinces of southern Canada; in other words, 'more remote' does not in this case mean 'less economic'. The study provides a detailed explanation for the comparative results. Implications for mining company planning and regional development policy are examined.

● *Pricing of metals,* by Margaret E. Slade. Centre for Resource Studies (see previous item). 149 pages, $20.

Radical changes in the pricing of non-ferrous metals occurred in the late 1970s and early 1980s. These led to a reduction in the role of producer pricing for some metals, the suspension of publication of producer prices for others, and increased reliance on metal exchanges for all. This study examines the causes and consequences of these changes. Among the factors identified as contributing to the weakening of the producer-pricing system are the decline in horizontal concentration and vertical integration of some markets, the increase in the importance of recycling of most metals, and the growth of international integration and government participation.

Both the level and variability of prices determined under the two systems are assessed. Contrary to conventional wisdom, exchange-based prices were not lower on average than prices set by the major firms in the industry. The principal difference across systems is the higher degree of volatility of exchange prices.

● *CRS Perspectives*, no. 29. Nov. 1988. Issued by the Centre for Resource Studies (see previous item).

This issue contains items dealing with the following: Strategic Change in CANMET, International R&D Trends, David Anderson Leads Queen's School of Business, and New Executive Director for CRS.

● *Introduction to the modern theory of metals,* by Sir Alan Cottrell. London, The Institute of Metals, 1988. 456 pp. £18.

The electron theory of metals has advanced greatly since the 1940s when the classic introductions to it for metallurgists were written by Hume-Rothery and Raynor. This new title builds upon the original theories and discusses the more recent developments, which explains conditions under which materials become metallic, including the nature of the metallic state, the renormalization theory of transition metals, and high-temperature oxide superconductors.

The text begins with an outline of the modern idea of the metallic state of matter and discusses the freedom and independence of electrons in metals. The pseudopotential theory of metals is used to examine the structures and properties of simple metals, and the cohesion of transition metals is explained through the application of tight binding.

Aimed at materials scientists and metallurgists, this text presents a new insight into the modern ideas of theoretical physics as applied to the solid state, particularly the metallic state of matter. It is accompanied by 3 classic reprints.

● *Mine winding and transport*, by S.C. Walker. Amsterdam, Elsevier, 1988. 546 pp. Dfl. 275.

Changes in the size and power of the available transport equipment in mines, combined with improved means of control involving leaky feeder radios and computers, demand a new look at the problem of mine winding and transport. Such changes require the traditional mining engineer to be aware of the new engineering applications. This book is intended to satisfy that requirement.

All the important means of transporting operatives and minerals are addressed, both below ground and on the surface. Safe, speedy, and economical transport from the point of mineral extraction is paramount. This work covers all aspects of the problem including the design and application of steel-wire ropes to a variety of industrial applications, and the various drums and pulleys necessary; a ready means of calculating the output/throughput of various transport modes, and relating such to their power requirement; and information on modes of transport that permits the selection of the most suitable system for given conditions.