journal of engineering materials and technology

book reviews

CREEP, VISCOELASTICITY AND CREEP FRACTURE IN SOLIDS, by John Gittus, Halsted Press, John Wiley, New York, 1975, pp. xxviii and 725 ($77.50).

REVIEWED BY IAIN LE MAY[1]

John Gittus has attempted to provide a comprehensive coverage of creep deformation and fracture in solids, together with a detailed review of viscoelasticity, within the covers of this book. The task is a formidable one and could easily have led to a superficial book of limited value to the serious worker. Happily, the result is very different, and this volume is a delight to read, and has a detailed and well referenced coverage of most of the wide range of topics and materials included.

Appropriately, in view of the author's experience and position with the United Kingdom Atomic Energy Authority, there is extensive coverage of creep problems of relevance to the nuclear field, including irradiation creep. This is particularly appropriate, as so much recent work has been done in this area, which is largely neglected in the existing reference books on creep of engineering materials; also, creep problems are of great and current concern in the nuclear industry. Young engineers and metallurgists should certainly be made aware of the importance of understanding in-reactor creep phenomena, and this book gives a good introduction to, and review of, these matters. In this connection, also, the author has extended the useful concept of Weertman and Ashby in deformation mapping to cover maps for irradiation creep.

The book provides coverage of both metals and non-metals, coverage of the latter ranging from viscoelasticity in polymers to the viscosity of the mantles of the earth, moon, and terrestial planets. Inclusion of all these topics means that, almost inevitably, some must be covered somewhat briefly; however the author has attempted to provide references to recent reviews in all these various areas, so the book should provide a good starting point in a literature search, and the unity of the treatment to cover all these materials is a valuable one.

From the point of view of the design engineer interested in high temperature creep life prediction, it is disappointing that so little space is devoted to extrapolation of creep data, and to rupture and related time-temperature parameters. The author passes over this matter far too quickly, providing a list of selected rupture parameters, without discussion or comment. Also, no mention is made of the important generalized time-temperature parametric "minimum commitment method" (MCM), devised by Manson, and which has been under study by the joint ASTM-ASME Committee on the Properties of Metals at Elevated Temperature. Discussion of this approach was given by Goldhoff at the 1973/74 International Conference on Creep and Fatigue in Elevated Temperature Applications (see also *JEMT*, January, 1974 issue, for Goldhoff's review of this conference). While this omission is to be regretted, it does not detract significantly from the book's overall value. It will, in any event, be of greater interest to metallurgists and to engineers with a bias towards research and development work, rather than to the designer. Nonetheless, it is to be hoped that many in the latter category will find the book of value in providing good background material and up to date information on the basics of creep, viscoelasticity and fracture.

[1]Technical Adviser, Mechanical and Metallurgical Engineering NUCLEBRÁS, Rio de Janeiro, Brazil. Mem. ASME.

HIGH-ALUMINA CEMENT CONCRETE, Adam Neville, Halsted Press (Division of John Wiley and Sons Inc., New York), 201 pp., $22.00, 1975.

REVIEWED BY P. K. MEHTA[2]

This book serves the public need in general, and that of the engineering profession in particular, by presenting a comprehensive yet unambiguous account of the behavior of high-alumina cements (HAC) in structural concrete. The publication is timely because, in the aftermath of recent collapse of HAC concrete elements in three school buildings in England, there is a world-wide concern about the safety of structures built with high-alumina cements. The author has made an important contribution to engineering literature by successfully destroying several myths about the use and long-term behavior of the product.

The 14 chapters of the book contain discussion on composition, properties, and use of HAC; strength loss associated with the instability of the hydration products of high-alumina cements; long-term behavior of HAC concrete both in laboratory and filed tests; structural failures of HAC concrete in France, United Kingdom, and other countries; analysis of the 1973 failures in the United Kingdom; rules on the use of high-alumina cement in structures; press reports and government circulars in the United Kingdom on the HAC problem; methods of appraisal of existing structures, and safeguards for the future.

The phenomenon of strength loss caused by increase in porosity of HAC concrete, when the hexagonal calcium aluminate hydrates convert to the more dense and stable cubic hydrate, is explained with utmost clarity. In order to clarify some of the ambiguities created by the statements of the producers of high-alumina cements, the author has included in the book a great deal of experimental data in support of his conclusions on the factors affecting strength loss. For instance, contrary to the published literature that conversion in HAC concretes can be prevented by avoiding the early overheating of the material, the data shown by the author clearly demonstrates that even when the exposure to warm temperatures was delayed for as long as six months, the strength loss could not be prevented. Similarly, the author refutes the suggestion that the conversion phenomena and the associated strength loss occur only under warm and wet conditions. Experimental evidence is included to show that even at a relative humidity of 65 percent and a temperature of 18°C

[2]Professor of Civil Engineering, University of California, Berkeley, Calif.