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Book Reviews

Plasticity and Creep of Metals. By J. D. LUBAHN AND R. P. FELGAR. Wiley, New York, 1961. 608 pp., $16.75.

Two different fields of engineering are represented by the authors of this book. Dr. Lubahn is a metallurgist, while Dr. Felgar's specialty is engineering mechanics. Both have had extensive industrial, as well as academic, experience. The former is presently Professor of Metallurgy at the Colorado School of Mines, but was previously at the General Electric Research Laboratory and the Case Institute of Technology. Dr. Felgar, who is now in charge of Mechanics of Materials at the space Technology Laboratories, has also had five years of teaching experience at the University of Texas.

These authors have produced a well-written and very readable book, covering in detail a very specialized viewpoint of the field of plasticity and creep in metals. The stated purpose of the authors is to place emphasis on those aspects of the subject which are of interest in engineering design. As a result they have eliminated all considerations of the mechanisms of creep and plastic flow. To the average metallurgist or solid state physicist, creep immediately implies the concept of thermal activation, and plasticity the subject of dislocations. Neither of these terms can be found in the index. This book also does not cover what might be considered the mathematical or theoretical aspects of the subject. As prerequisites, the authors recommend courses in strength of materials and simple differential equations.

Perhaps the best way to characterize the book is to say that it is an engineering experimentalist's approach to the subject, based primarily on data from mechanical tests. The first four chapters are essentially a review of strength of materials. Following this, there are good treatments of the factors involved in simple tensile tests and creep tests, as well as the inter-relations between the two types of tests. The completeness of the coverage of the subject of plasticity from the experimental viewpoint is demonstrated by the fact that separate chapters are devoted to such topics as anelastic creep and the Bauschinger effect. Controversial concepts, such as the mechanical equation of state, are covered rather well. Complex deformation resulting from multiaxial stresses, as well as deformation in anisotropic materials, are also treated.

In general, the reviewer believes that most metallurgists and engineers concerned with the testing of metals might be interested in purchasing this book. The large amount of experimental information which it contains makes it of value for this reason alone. In this regard, there are over 300 illustrations of which a great majority are curves based on empirical data. However, in the reviewer's opinion, it would be extremely unfortunate if the design of metal structures were to be based only on the accumulated data obtained from metals chosen at random, with no basic knowledge or understanding of the processes of plastic deformation. Thus, consider the subject of anisotropic plastic flow which receives an extensive treatment near the end of the volume. Here, as an illustrative example, the authors consider the plastic flow of Zircaloy-2 in the form of tubes under combined loading: tensile plus internal pressure. The analysis which they give corresponds to the observed results on one particular heat of this metal. The anisotropy of plastic deformation in a given metal, however, is a function of its texture, which can be radically altered by relatively minor variations in fabrication procedures during manufacture. The detailed analysis given in the book is thus of doubtful value for design purposes if metal from other heats of this material is to be used. In the reviewer's opinion what is obviously needed is a better understanding of the relationships of mechanical anisotropy to textures. This will never come from simple mechanical testing alone, but from a combination of mechanical testing and a study of the causes for the observed phenomena.

Problems are included at the ends of the chapters, but there is no appendix or general set of tables of physical constants applicable to the material which is treated in the book. The authors of quoted references are not indexed at the end of the book.

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(About the Reviewer: R. E. Reed-Hill, is currently Associate Research Professor, Metallurgical Research Laboratory, University of Florida. He has over twenty years of teaching experience in metallurgy and engineering. Dr. Reed-Hill's primary interest is in mechanical metallurgy.)

Atomic Energy Waste, Its Nature, Use and Disposal. Edited by E. GLUECKAUF. Interscience, New York, 1961. 420 pp., 4 plates, 105 figures, 84 tables; $14.00.

The editor, Dr. E. Glueckauf, has brought together a volume in six parts concerned with the nature, use, and disposal of atomic energy waste. To accomplish this, he has drawn upon the experience and competence of 23 of his associates in the nuclear engineering field to prepare the 17 chapters that are included. About half the volume is devoted to the nature (sources) of atomic wastes (2 chapters), and to the effects of radiation on materials and living organisms (4 chapters). A single chapter is concerned with the legal aspects of the problem. The latter half of the book covers waste disposal practices (5 chapters—117 pages) and utilization of high level sources of radioactive materials (5 chapters—84 pages). In essence, the volume reviews much

of the published work in England, the United States, and Canada in this field. As expected, English practice is considered in more detail.

The volume cannot be considered as a text book on waste disposal since certain aspects of waste disposal are not covered at all. Rather, it concentrates on the utilization of the liquid fission product waste as a source of ionizing radiations. Omitted from the text is any discussion of the problem of disposing of wastes from the beneficial application of small quantities of radioactive materials (the normal radioisotope user) because this subject ". . . would easily fill a separate volume, . . ."; there is little if any discussion of the disposal of radioactive wastes from hospitals (not a subject in the index); there is no discussion of the handling or disposal of solid wastes; except for the excellent chapter on "Dispersion of Activity from Chimney Stacks" by Chamberlain, there is no discussion of the handling, treatment, or disposal of gaseous wastes, aerosols, or airborne particulates generated during nuclear energy operations; and there is no discussion of the waste problems associated with fixed nuclear power production stations and mobile reactors associated with propulsion of vessels. There are omissions in waste handling, treatment, and disposal of interest to the reviewer and to other workers in the field. To these may be added some of the more recent approaches studied in the United States for the disposal of low and high activity wastes such as deep well disposal, disposal into soil formations, hydrofracturing, and the use of such natural materials as clinoptilolite. Discounting these omissions, the sections on waste handling, treatment, and disposal are well prepared and factual.

Several errors appear as a result of typographical errors, faulty proofreading, etc., but these do not detract much from the text. Several errors of fact should be called to the attention of the reader, namely: on page 227 reference is made to slow sand filtration, whereas trickling filters is meant; on page 251 monthly release to the Thames from Harwell should not exceed 20 curies—not 2 as indicated; on page 258 a second source of liquid effluent is given although this reviewer cannot find a first source; on page 259 the statement is made that the single pass water used to cool the Hanford reactor is demineralized—it is treated by normal coagulation but not demineralized; on page 275 the decay scheme for ^{106}Ru to ^{106}Rh to ^{106}Pd (stable) shows only beta emissions, whereas ^{106}Rh decays by both beta and gamma emission as does ^{103}Ru; and the definition of rad given in the glossary should read: The rad is a unit of absorbed dose, which is 100 ergs per gram in any medium. It is a measure of the energy imparted to matter (i.e., retained by matter) by ionizing radiation per unit mass of irradiated material at the place of interest.

In summary, the volume is interesting and presents a tremendous amount of widely scattered information in a single document. The few deficiencies (generally minor) referred to earlier should not detract from the use of the volume by all levels of workers concerned with the utilization, handling, treatment, and disposal of radioactive materials.

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(About the Reviewer: Conrad P. Straub is Chief of the Radiological Health Research Activities in the Division of Radiological Health at the Taft Sanitary Engineering Center in Cincinnati. He joined the Public Health Service in 1941 and completed his PhD with Cornell University in 1943. He is the Chairman of the Committee on Handling and Disposal of Radioactive Wastes of the International Commission of Radiological Protection, a member of the Expert Advisory Panel on Radiation of the World Health Organization, and a consultant to the Food and Agriculture Organization. He currently is preparing a book on Low Level Radioactive Wastes—Their Handling, Treatment, and Disposal.)

Reactor Handbook, Volume II, Fuel Reprocessing. Second Edition. Edited by S. M. STOLLER AND R. B. RICHARDS. Interscience, New York, London, 1961 665 pp., 410 tables, 645 illustrations, $21.40.

The expressed objective of this volume is to present a condensed version of the data available on chemical reprocessing as of early 1960. To accomplish this the editors have recruited an impressive list of specialists in the various fields as authors. The authors have purposely emphasized engineering and operational concepts rather than basic science and have given a comprehensive list of references.

The text is written in six parts:

A: Introduction; including chapters on reactor system effects and reprocessing and reconversion economics.

B: Aqueous separations processes; including chapters on head-end processes for solid fuels, aqueous separation, reprocessing of aqueous fuel, and fluoride and other halide volatility processes.

C: Nonaqueous separations processes dealing with pyrometallurgical processes.

D: Reconversions; including chapters on natural, slightly enriched or depleted uranium chemistry, highly enriched or fully enriched uranium chemistry, thorium chemical reconversion, plutonium reconversions, and isotopic enrichment.

E: Radioactive waste disposal; including chapters on gaseous waste, liquid waste treament and disposal, solid wastes.

F: Engineering; including chapters on plant design, equipment design and plant management.

The chapter on reprocessing and reconversion economics gives a breakdown of capital and operating costs for a multipurpose processing facility which is of general interest. The comments relating to over-all power cycle costs use U. S. ground rules and are of value primarily to U. S. readers. The section on head-end processes for solid fuels deals with most proposed power reactor fuels in a most comprehensive manner. In the section on aqueous separation the currently significant aqueous separation processes are discussed in detail. Sufficient basic data is provided to allow calculation of optimum flowsheet conditions for a wide variety of fuels. The calculation methods are also provided and a useful record of operating experience is given. Reprocessing of the proposed homogeneous reactor fuels uranyl sulphate, uranyl phosphate, uranyl nitrate, and uranyl fluoride is discussed in the section on reprocessing of aqueous fuel. Slurries, D_2O recovery, and blanket reprocessing are also covered. The section on halide volatility processes gives a comprehensive tabulation of the pertinent physical and thermodynamic properties of the various