BOOK REVIEWS

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

Safety Problems Related to Sodium Handling in Liquid Metal Fast Breeder Reactors and Large Test Facilities

Editor	H. M. Kottowski
Publisher	Harwood Academic Publishers, New York (1982)
Pages	251
Price	$30.00
Reviewer	Mujid S. Kazimi

This book is an outcome of a short course held at Ispra, Italy, in November 1980. It contains nine chapters authored by different individuals who had substantial involvement in sodium handling at European research establishments. True to the scope of its title, the book contains material covering sodium chemistry, radioactivity, and fire hazards to containments and to individuals. It is written in an easy language meant to be understood by engineers and technicians of various backgrounds. The book unfortunately remains a collection of articles, not well integrated and with substantial variety in the depth of coverage.

The first chapter, authored by H. M. Kottowski of Ispra, is a survey of the fundamentals of sodium chemistry. This includes methods of analyzing the contaminants of sodium (oxygen, carbon, hydrogen, and nitrogen) and the sensitivity of the reaction rates with gases, metals, and other materials to temperature and the presence of catalysts. The alloys of sodium with lead, mercury, lithium, and potassium are also discussed.

Chapter 2, authored by H. H. Stamm of Karlsruhe, describes the radioactivity characteristics of sodium in a liquid-metal fast breeder reactor (LMFBR). Attention is given to activated sodium atoms, radioactive corrosion products, and fission products from failed fuel. The experience at the KNK research LMFBR reactor is highlighted, while it is acknowledged that the KNK has a ferritic steel structure, which is not a common feature of the LMFBR. Methods of cleanup are also discussed.

Chapters 3, 4, and 5 address the sodium fire problems. The authors come from different establishments (J. Higson from Risley Laboratories, W. Peppler from Karlsruhe, and J. C. Malet of CEN Cadarache). This, however, was not enough to guard against overlap. All three chapters discuss the chemistry of sodium reactions with air, water, insulation materials, and concrete, as well as methods of fire extinguishment. There is a heavier discussion of experimental observations than of fundamentals or analytical techniques. In Chaps. 4 and 5, the reader will find a discussion of the differences between sodium fires and hydrocarbonic fires. The passive and active methods of fire extinguishment, including several types of powders that can be used to cover the pool area, are outlined.

Fire-generated aerosols and their removal characteristics are discussed in Chaps. 6 and 7. However, here the chapters complement each other. Chapter 5, authored by S. Jordan of Karlsruhe, reviews the results of pool fire experiments at the German FAUNA facility as well as at Hanford Engineering & Development Laboratory (HEDL). Particle diameters, surface roughness, chemical composition, and deposition rates are discussed. Chapter 6 by V. Prodi of the Laboratory of Fiska Sanitaria, Bologna, Italy, is devoted to analytical descriptions of aerosol behavior. All the necessary formulations, but only few calculated results, are presented.

In Chap. 8, W. Holst of Ispra provides a capsule of instructions for protection of a worker's body and clothes. Chapter 9 by C. Savatteri of Ispra is an overview of the practical requirements for handling sodium in a working environment. However, some of the chemistry already covered is discussed again and little space is devoted to protective measures, packing, and transport issues.

According to its introduction, the book is an attempt to educate engineers, plant operators, regulatory personnel, and others concerned with the safety aspects of sodium handling. Hence, its readership is not a homogeneous one. Combining the interests of the scientist, the plant engineer, and the research technician may not leave any of them fully satisfied. However, given that no other book on the subject is readily available, this book is likely to be very useful in introducing the subject to all three types.

The book does not contain the more recent information on sodium reactions with concrete generated at HEDL and Sandia National Laboratories. It also lacks a reflection on the sodium handling practices at larger LMFBRs such as the Phénix in France or the Prototype Fast Reactor in the United Kingdom.

Readers of *Nuclear Technology/Fusion* who are potentially more interested in lithium handling and safety issues should be aware that, in spite of the similarity in the concerns to sodium, significant differences exist in the particular materials that can be used for routine operation or mitigation of accidents. Interestingly, the information on lithium handling that has accumulated so far leads to the conclusion that it does not pose demands beyond those normally associated with sodium.

Mujid S. Kazimi is an associate professor of nuclear engineering at the Massachusetts Institute of Technology (MIT). He has extensive publications on safety concerns of

the LMFBR and of fusion reactors. For the last five years he directed MIT's fusion safety methodology development effort, part of which is LITFIRE, a computer code for modeling lithium fires in fusion reactors.

Fusion Research

Author	T. J. Dolan
Publisher	Pergamon Press, Elmsford, New York (1982)
Pages	855 (3 volumes)
Price	$120.00 hardcover, $75.00 paperback
Reviewer	Edward C. Morse

The purpose of this book is to describe the methods of fusion research currently in use and to describe the prospects for fusion power that may lie ahead. The book is written in textbook style in that there are problem sets, an answer key, and references for further study of the topical areas. The preface also suggests that the book is useful to workers in the field as well. The book is divided into three sections. The first is a physics section, the second is a description of current experiments, and the third is a look at the technology of proposed reactor schemes. All three contain an overwhelming amount of material, and the book has a "one of everything" style similar to the classic Glasstone texts in nuclear engineering.

The first volume of the book, titled "Principles," assumes no background other than freshman calculus and physics and ends with a fairly sophisticated overview of plasma diagnostic techniques to be applied to the tokamak fusion test reactor. I doubt whether a naive reader could really go from the right-hand rule through plasma turbulence in a little over 250 pages, but the intentions are certainly honest, and the references are good.

Included in the first volume are a brief overview of the world energy situation, a discussion of distribution functions and nuclear reactions, and some atomic and molecular physics. From there the author derives a power balance equation for a fusion reactor. After the reader sees the motivation for high values of the confinement parameter $n\tau_E$, the basic physics of plasma is introduced, with both microscopic and macroscopic viewpoints discussed. The emphasis in this physics section is on experimental as well as theoretical issues, with a strong chapter on plasma diagnostics.

The second volume, containing descriptions of all fusion experiments, past and present, is a compilation of hundreds of laboratory reports and journal articles. Some forty-odd experiments are described in varying detail. Almost no editorial viewpoint is present, either by comments on the relative merits of the various concepts presented or by selective coverage. The approach is to give as much information as has been documented in each area of experimental fusion research. This second volume is more suited as a reference book than as a text.

While the information contained in this volume is as up-to-date as possible, a treatment of this kind always runs the risk of being out-of-date quickly in the fast-paced world of experimental fusion research. However, one can read the older Glasstone and Lovberg book (first published in 1960) and still learn from the experimental evidence of the day. In that respect, the experimental chapter is a good chronicle of the 22 years of experimental progress since Glasstone and Lovberg.

The fusion technology section of this text, presented in the third volume, is a fairly general discussion of the various high-technology endeavors that are necessary in fusion systems: superconducting magnet coils, vacuum systems, radiation shielding, and exotic materials problems. The calculations discussed are a potpourri of nuclear, mechanical, and electrical design problems. Similar in style to Volume 1, the approach is to assume no background in strength of materials, neutronics, thermodynamics, or heat transfer. While some areas are covered in laborious detail, such as coil design and blanket neutronics, other areas are a bit sparse of fundamental information, such as the section on reactor materials problems due to neutron irradiation. If used as a text, one would want supplemental material in this area. In keeping with the general style of the book, however, there are ample references to the literature of this very important field.

On the whole, the book is interesting, well balanced, and organized. It is expensive compared to other texts. A student asked to purchase a course text for $75.00 will understandably balk. However, when one considers that the material contained is enough for a course in plasma physics and fusion technology, as well as an introduction to fusion research, perhaps this is not a high price for an integrated program of study in fusion. I commend Prof. Dolan in his brave attempt to document the entire nebulous and eclectic field of fusion research, even though it took three volumes.

Edward C. Morse (BS, electrical engineering, 1975, and PhD, nuclear engineering, 1979, University of Illinois, Urbana-Champaign) has studied the stability of the field-reversed mirror. He was a National Science Foundation fellow from 1975 to 1978. Dr. Morse joined the faculty of the University of California at Berkeley in 1979 as an assistant professor in the Nuclear Engineering Department. He had the distinction of being the youngest faculty member in the engineering college. He is now involved in the studies of plasma physics aimed at fusion devices, with areas of interest in particle simulation, radio-frequency (rf) interaction in plasmas, and rf driver technology.

World Survey of Major Activities in Controlled Fusion Research
(4th Edition)

Editor	Dorianna Twersky
Publisher	International Atomic Energy Agency, Vienna, Austria (1982)
Pages	429
Price	$49.00
Reviewer	Chan K. Choi

The present edition of the "World Survey" has been long awaited. Three previous editions were published in