

BOOK REVIEWS

Powder Metallurgy Equipment Manual (Third Edition)

Reviewed by W. Brian James, Hoeganaes Corporation, Riverton, NJ 08077.

REFERENCE: *Powder Metallurgy Equipment Manual*, 3rd ed., Samuel Bradbury, Ed., Metal Powder Industries Federation, Princeton, N. J., 1986, 200 pp., \$45.00.

Prepared by the Powder Metallurgy Equipment Association on behalf of the Metal Powder Industries Federation, this is the third edition of a book originally published in 1968. This third edition has been "completely revised to reflect current practices and the latest process equipment."

While the *Powder Metallurgy Equipment Manual* contains a wealth of information for the experienced and novice powder metallurgist, it does have a number of serious shortcomings. The book has no index, which makes specific items hard to find and reduces the usefulness of the text as a ready reference. In addition, there are no references listed to permit the reader to find more detailed information on items of interest. There are also many typographical errors in the text.

The text is subdivided into five major areas:

- Mixing
- Compacting
- Sintering
- Optional Operations
- Glossary

Mixing, optional operations, and the glossary are new additions to the book. The coverage of mixing is, however, very limited. While the inclusion of this topic is a logical addition to the previous version of the book, the way the topic has been handled makes it appear to be somewhat of an afterthought.

The new section on optional operations is handled considerably better than that on mixing. It covers topics such as repressing, machining, heat treatment, and surface protection. However, material considerations in the section on heat treatment are very poorly covered. This section also contains factual errors such as:

- "Copper does not increase hardenability. . . ."—It does!
- Alloy Steels—"4600, 4300, 4400 and 8600 grades currently available. . . ."—Of the grades listed, only the 4600 grade is commercially available. It should also be noted that the chemical composition of the powder metallurgy alloy differs considerably from that of the AISI 4600 grade.

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The extremely limited coverage of copper infiltration is somewhat surprising considering how widely it is used by the industry.

The strength of the book lies in its presentation of cold compaction of powders in rigid tooling, and the practical aspects of sintering, furnace construction, and protective atmospheres. This was the basis for earlier editions of the book.

The section on powder forging contains a large number of misleading statements, and some of the terminology is not in line with current practice.

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Overall, I do not feel this third edition is much of an improvement on the second edition. However, with revision of the weaker sections already mentioned, the addition of selected references, and most importantly the incorporation of an index, the book would be a good source of information for the practicing powder metallurgist.

NCRP Report No. 93: Ionizing Radiation Exposure of the Population of the United States

Reviewed by J. E. Turner, Health and Safety Research Division, Oak Ridge National Laboratory, Oak Ridge, TN 37831.

REFERENCE: "NCRP Report No. 93: Ionizing Radiation Exposure of the Population of the United States," National Council on Radiation Protection and Measurements, Bethesda, Md., 1987.

The National Council on Radiation Protection and Measurements (NCRP) is a nonprofit corporation chartered by the U.S. Congress in 1964. The Council members and other participants serve on some 80 scientific committees of the NCRP, covering virtually all aspects of radiation and radiation protection. The Reports of the NCRP represent an invaluable source of basic information and recommendations. Among its many responsibilities, the Council has undertaken the evaluation and assessment of exposure to the U.S. population from all sources of ionizing radiation. Their findings are published in this timely Report No. 93.

An Introduction defines the scope of the Report and its relation to other publications on population exposures from a number of organizations. The quantities and units employed in the Report are defined. The material is then organized into six sections, which deal with radiation sources according to the origins of exposure. These sections address, respectively, natural background, occupational activities, nuclear power generation, consumer products, environmental sources related to human activities ("enhanced" natural sources), and medical diagnosis and therapy. A glossary of terms is also included.

Each subject is treated succinctly, with liberal references to the literature. Detailed numerical data are given in a number of tables, which are clear in their presentation. The tables and text include explanations of the data along with statements about uncertainties and limitations where appropriate. The Report does an excellent job of organizing and presenting a comprehensive coverage of its subject.

Estimates of the effective dose equivalent and the gonadal dose equivalent (and/or the genetically significant dose) are presented for each of the six radiation source categories. The contributions of each to the total average effective dose equivalent and genetically significant dose are discussed in a Summary and Conclusions section. Natural radiation is estimated to contribute 82% of the total average effective dose equivalent to the population of the United States. The distribution among the natural sources is 55% from radon, 11% from internal emitters, 8% from external terrestrial

emitters, and 8% from cosmic rays. The 18% of the total average dose equivalent estimated from man-made sources is comprised of 11% from medical X-rays, 4% from nuclear medicine, 3% from consumer products (e.g., building materials, domestic water supply, and use of natural gas), and less than 1% from all other man-made sources (e.g., fallout and the nuclear fuel cycle). The average total effective dose equivalent from all sources to persons in the United States is estimated to be approximately 3.6 mSv/yr (360 mrem/yr), or about 0.01 mSv/day (1 mrem/day). (Some additional effective dose equivalent from radionuclides in tobacco products is to be added for smokers. This exposure results in a relatively high dose equivalent to part of the bronchial epithelium, the contribution to the effective dose equivalent being difficult to estimate.) The average genetically significant dose equivalent is estimated to be 1.3 mSv/yr (130 mrem/yr) from all sources.

Report No. 93 presents some recommendations for dose reduction. Radon is the largest and most variable contributor to the average effective dose equivalent in the United States. Indoor radon is receiving wide national attention, and one can anticipate reduction of population exposure from this source. Efforts are being applied to keep medical exposures to individuals as low as possible, consistent with obtaining needed diagnostic information. Reduc-

tion of the effective dose equivalent from consumer products does not appear to be feasible or cost effective in most instances, except perhaps for reducing radon from domestic water supplies and natural gas. The NCRP considers exposures below 0.01 mSv/yr (1 mrem/yr) to entail a negligible risk to an individual and not to be of further concern. Dose-reduction measures beyond those in place do not appear to be warranted, therefore, for most consumer products and for the nuclear fuel cycle. Other recommendations are made for obtaining improved data for continuing and future assessments of population exposures. The Report suggests that another assessment of the exposure of the U.S. population be made in about ten years.

NCRP Report No. 93 is very well organized, concise, and clear in covering its subject of radiation exposures to the population of the United States. An extraordinary amount of data is summarized, clearly presented, and critically evaluated in the 60 pages of the body of the Report. It is informative reading for anyone interested in obtaining a picture of how various sources of radiation make up the total exposure to persons living in the U.S. The radiation specialist will want to study the Report and have it in his library. This reviewer compliments the work of the NCRP's Scientific Committees that resulted in the publication of Report No. 93.