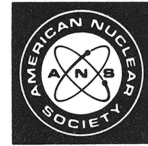


BOOK REVIEWS

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.



Neutron Transmutation Doping of Semiconductor Materials

Editor Robert D. Larrabee
Publisher Plenum Press, New York (1984)
Pages 336
Price \$75.00
Reviewer Kaj Heydorn

Neutron transmutation doping has come of age with the completion of four international conferences exclusively devoted to this particular technique of semiconductor production. The present book contains the proceedings of the fourth and last conference, held at the U.S. National Bureau of Standards in Gaithersburg, Maryland, June 1-3, 1982.

The unsurpassed uniformity of doping that can be achieved with this method has led to a commercial development from a few kilograms in 1974 to ~50 tons in 1984. The original use of the material for high-voltage direct current thyristors is now supplemented with power transistors and diodes, but not with IC applications.

This volume contains papers on the processing and characterization of neutron-transmutation-doped silicon and the use of the material in semiconductor power devices. In addition there are papers on irradiation technology from the major suppliers of neutrons and on the transmutation doping of other semiconducting materials. Although the book contains 24 valuable and interesting contributions, the long publication time severely detracts from their value. These proceedings of the fourth conference were not yet available when the participants gathered again for the fifth time in February 1984 in conjunction with the American Society for Testing and Materials Symposium on Semiconductor Processing. Proceedings of this latter symposium are already out; they include ten papers on neutron transmutation doping and, together with the present volume, represent the state of the art of the field. Future papers on neutron transmutation doping are likely to be found in the context of semiconducting materials in general.

Kaj Heydorn has been involved in the neutron transmutation doping of silicon since its inception and, in cooperation with the Danish company Topsil, pioneered its commercial introduction. His main interests include analytical quality control, and he has been appointed general chairman of the 7th International Conference on Modern Trends in Activation Analysis, which is to be held in Copenhagen in 1986.

Principles of Radiation Shielding

Authors A. B. Chilton, J. K. Shultis, and R. E. Faw
Publisher Prentice Hall, Inc., Englewood Cliffs, New Jersey (1984)
Pages 488
Price \$39.95
Reviewer G. Hehn

This hardbound book with its attractive layout is intended as a beginner's text for the discipline of radiation shielding. Radiation protection and shielding help to optimize the use of nuclear radiation in numerous applications ranging from reactor technology to the medical use of ionizing radiation, which are the most important fields. In the preface of the book, the authors state that the fundamentals of radiation shielding can be treated in a general way without any restriction to a specific field of application. This concept is then followed convincingly throughout the text. The presentation of the fundamental quantities is short, didactically elegant, and consistent with internationally agreed upon definitions and units. The mathematics required for the various approximating techniques in shielding is covered well. The mathematical functions as well as the integral shielding data can best be stored and handled by microcomputers.

To reduce conservatism and overdesign in shielding, which is of high importance to the economy and future of nuclear technology, we have to apply more sophisticated transport methods with the help of macrocomputers. About

55 pages are devoted to introducing the basic transport equation and its main solutions, such as the discrete ordinates and the Monte Carlo methods, including the moments method as a fruitful historical singularity.

The following topics are treated in detail:

1. characterization of radiation fields and sources
2. interaction of radiation with matter
3. common radiation sources encountered in shielding design
4. detector response functions
5. basic concepts in neutral particle penetration
6. special techniques in photon attenuation
7. special techniques in neutron attenuation
8. approximate techniques under special geometric conditions
9. transport description of radiation penetration
10. material and structural considerations in shielding design.

Each chapter has its own proper references and is followed by a set of typical problems showing various fields of application. In several appendices, mathematical functions and nuclear data are listed, which are important for shielding analysis.

The presentation of a large variety of different response functions for the evaluation of hazards to human beings demonstrates a general uncertainty, which should be solved

by convention as quickly as possible. We can hope only that the primitive free-field dose equivalent will be abandoned in favor of the phantom related dose equivalent and that the ICRU sphere of tissue equivalent material will be the winner internationally. If in the latter case the angular flux is also taken into account, an appreciable reduction of conservatism can be achieved, because the parallel beam penetration into the phantom, as given in the book, is the worst case, where the main advantage of the new phantom related quantity is lost.

The book can be highly recommended to beginners and especially to students of nuclear engineering. They can truly profit from a text that has evolved from broad experience in lecturing on radiation protection and shielding, but shielding experts as well will buy the book, eager to study and to use it.

Dr. G. Hehn is deputy head of the reactor physics department of the Institute of Nuclear Technology (IKE), University of Stuttgart, Federal Republic of Germany. His main fields of research are radiation shielding in fission and fusion technology, radiation damage, and diagnostic application of radiation. As an expert he participated in several technical program committees of international conferences and in various specialists' meetings of the International Atomic Energy Agency and Nuclear Energy Agency of the Organization for Economic Cooperation and Development. He is an active member of the German Nuclear Society, KTG, and has a hobby in the field of nuclear terminology being chairman of the pertinent section in the German Standardization Organization, DIN.