UNUSUALLY LUCID

Title Effects of Radiation on Semiconductors

Author Viktor Sergeevich Vavilov

Publisher Consultants Bureau Enterprises, Inc., 1965

Pages *xi* + 225

Price $15.00

Reviewer H. Y. Fan

This book deals with the effects of light waves and high-energy charged particles on semiconductors. The interaction between matter and electromagnetic waves lead to the absorption and dispersion of the waves and to electronic excitation and ion vibrations in the matter. Electronic excitation produces photoconductivity. The first two chapters treat light absorption and photoconductivity in semiconductors. Under a given excitation, the photoconductivity depends on the decay or recombination rate of the excess conduction electrons or holes. Photoconductive phenomena, and particularly the recombination effect discussed in connection with it in Chapter II, are important for the understanding of semiconductor devices.

Chapter III concerns the ionization effect of charged high-energy particles. The subject is basically important for the application of semiconductor detectors of such particles. Structural changes produced by energetic particles and their effects on the properties of the semiconductor are the subject of the third chapter which occupies about one-third of the book. Structural changes include lattice defects resulting from displacement of atoms from their regular positions, and foreign atoms on regular lattice sites resulting from nuclear reactions. Both types of structural changes and their effects are discussed. The discussion covers the effects of fast electrons, gamma rays, neutrons, and heavy charged particles. The material presented in this chapter should be useful for the application of semiconductor devices in the environment of such radiations.

Chapter IV treats the phenomena of light emission from semiconductors under the excitation of light or fast electrons. The conditions for obtaining stimulated emission are considered. This chapter seems to be of secondary interest for nuclear science.

This book is written by an expert who has applied optical and photoconductive measurements to the study of radiation damage of semiconductors with great success. The presentation is unusually lucid, making the material easily understandable. The reader will find the book useful and interesting without having to be a specialist in the field.

H. Y. Fan is Duncan Professor of Physics at Purdue University. He received his DSc from Massachusetts Institute of Technology in 1937. He was Assistant Professor, then Professor at the National Tsing Hua University, Kunming and Peiping, China, during the period 1937 to 1948. He joined the faculty at Purdue in 1948. His specialty is semiconductor physics, and his main research contributions have been on optical properties of semiconductors, and on radiation damage in semiconductors.

WHAT MAN HAS JOINED TOGETHER

Title Handbook of Electron Beam Welding

Authors R. Bakish and S. S. White

Publisher John Wiley & Sons, Inc., 1964

Pages *ix* + 269

Price $11.50

Reviewer Bruce M. MacPherson

This handbook gives the first practical dissertation of the welding process that utilizes electron-beam energy sources for joining, which in the last few years has become an established tool for industry. The authors have made a fair appraisal of the electron-beam welding process and the milestones of its brief history.

Commercial electron-beam welding equipment may be evaluated in two categories based on accelerating voltage—high- (150 kV), and low-voltage (15 to 40 kV). This book lists the commercial manufacturers and general specifications for their electron-beam welding equipment. Some analysis of the controversy over low- vs high-voltage electron-beam equipment can be derived from the data presented.

Although the authors have rightfully devoted large sections of the book to equipment and metallurgy, it should be understood that the process is in its infancy and that development, research, and engineering efforts in these two areas are indeed still needed, as noted by the numerous development programs that the government has sponsored, including one in the area of beryllium metal. The physical and mechanical metallurgy data of joints in beryllium, aluminum, titanium, steel, Zircalloy, columbium, molybdenum and tungsten are presented in this book. Even though the data presented are not complete due to the rapidly advancing technology in these areas, it should provide a useful guide to both newcomers and users seeking to broaden their areas of electron-beam welding application.

Beryllium is one of the more difficult metals to weld, and though beryllium has not been electron-beam welded with the success that has been obtained with the other metals and alloys covered in this book (the high-energy density electron beam normally associated with electron-beam welding has not been shown to be practical with beryllium), welds by this process under certain conditions can be made with beryllium. In fact, beryllium welds were made under J. A. Stohr's supervision in the French Atomic Energie Laboratory at Saclay with their original equipment.

Precision tooling is essential to electron-beam welding due to 1) a highly focused beam, 2) the autogenous nature of such work, and 3) inaccessibility of the vacuum atmosphere chamber. Under these conditions, jigging, fixturing and control, and manipulating the gun become significant factors in electron-beam welding and a chapter in the book gives some basic information on these subjects. Since precision tooling may cost more than the basic electron-beam welding equipment, which is itself quite costly compared to other welding equipment, the authors' ideas on requirements for profitable utilization of electron-beam welding units, despite their considerable initial cost, is valuable. The chapter on electron-beam welding standards should act as an incentive and possibly a reference for establishing specifications for electron-beam welding. For practical purposes, such specifications are nonexistent in the industry.

Handbook of Electron Beam Welding should serve a necessary function as a source for basic electron-beam welding technology and its history.

B. M. MacPherson joined the Goodyear Aerospace Corporation as Welding Engineer in 1953. A year later and until 1956, he was with the Jet Division of Thompson Aircraft Products, Inc. (now Thompson-Ramo-Wooldridge) as a Metallurgist, engaged in joining and forging development of high-temperature alloys. Since March 1956, he has been employed at The Brush Beryllium Company in the Metallurgy Division developing brazing, fusion welding, and other joining methods. He received his degree of Bachelor of Metallurgical Engineering from Fenn College in 1953.

REFRESHING, DIRECT, AND ENTHUSIASTIC

Title Industrial Isotope Techniques

Authors Lars G. Erwall, Hans G. Forsberg, and Knut Ljunggren

Publisher John Wiley & Sons, Inc., 1965 (English Ed.)

Pages 338

Price $19.50

Reviewer John F. Cameron

This book describes the applications of radioisotopes in industry and is written by authors who have spent almost their entire careers working on the subject. Therefore, as would be expected, it is an excellent account of the very wide range of applications.

The original material was prepared as a training course for industrial personnel and consequently includes introductory sections dealing with nuclear theory, interactions of radiation with matter, with radiation detectors, and auxiliary electronics. These sections are brief, but contain all the essential information necessary to understand the subsequent chapters. Of the chapters dealing with the industrial uses of radioisotopes, those on tracer techniques and analysis are the best. Very few textbooks deal with these subjects and, therefore, a description of the salient points, by authors who have developed many of the techniques and explained them to all types of audiences, is extremely valuable. Examples of the calculations involved in tracer techniques enable the book to be used as a unique practical guide to those who wish to conduct such experiments themselves. The chapters on radioisotope gauges, radiography, and on applications based on the effects of radiation are good summaries of what can be done with these techniques. They are not as detailed as the chapter on tracers but the techniques and applications are described precisely and in sufficient detail to satisfy everyone except a specialist.

Contained in the Appendixes are data on the radioisotopes most used in industry and other diagrams and nomographs useful for planning industrial experiments. The index is divided into two parts: one contains nuclear terms and titles of radioisotope techniques; the other lists the applications in different industries. This should be useful to the industrialist who wishes to see quickly what has been done in his particular industry, but should not mislead him into thinking that techniques used in other industries cannot also be used with advantage.

The occasional unusual phrase used reveals that the writers do not use English as their mother tongue but, generally, the grammar is correct and the style is refreshing, direct, and enthusiastic.

This is a book that should be read by everyone interested in the subject. The isotope specialist or research scientist who is too specialized can find out what is happening in related fields, and industrialists, ranging from managers to service personnel and those connected with radiation protection, will all find useful information.

From 1951 to 1962, John F. Cameron was with the Isotope Research Division of the United Kingdom Atomic Energy Authority at Harwell and Wantage, working on the development of industrial radioisotope techniques. Later, he specialized on instrumental techniques such as radioisotope x-ray fluorescence, accelerator-type neutron sources, and low-background counting. He joined the International Atomic Energy Agency in Vienna in 1962, where he was initially engaged in hydrological uses of isotopes and in setting up a laboratory to concentrate and count water samples containing low-activity tritium. He is now responsible for promoting industrial application of radioisotopes. Cameron graduated from Glasgow University in 1950 with an honors BSc in mathematics and physics.