Book Reviews

Radioisotope Applications Engineering. By J. KOHL, R. D. ZENTNER, AND H. R. LUKENS. Nuclear Science Series. Van Nostrand, Princeton, N. J., 1961. 562 pp., $16.50.

The authors, Jerome Kohl, Coordinator of Special Products, General Atomic Division of General Dynamics Corporation, René D. Zentner, Attorney at Law in Berkeley, California, and H. R. Lukens, Jr., Radiochemist, Shell Development Company, were previously associated with Tracerlab, Inc. They have, in common, training and experience in chemistry and radiochemistry and have engaged in radioisotope application course presentation at the University of California, Engineering and Sciences Extension.

This adequately illustrated publication presents a summary of major reported radioisotope applications in the instrumentation, petroleum, chemical, radiation, pharmaceutical, and food processing industries. The introductory chapters dealing with basic radiation physics, production of radioisotopes, measurement of nuclear radiation, statistics of radiation measurements, and tracer selection can serve as background information for persons not trained in radioisotope technology who desire to gain an understanding of how the radioactivity of radioisotopes is usefully applied.

The intermediate chapters dealing with calculations for a tracer experiment, legal aspects of atomic energy, radiological safety, radiation attenuation, radioisotope radiography and process uses of radiation, in this reviewer's opinion, are the highlights of the book because of their content and fine presentation. This material should interest those who understand the basic principles behind isotope application and seek information regarding the practical problems associated with procuring and using them.

The final chapters dealing with flow and leakage measurements, concentration measurement, wear studies, density thickness gaging, and process instrumentation serve as a compilation of reported demonstrations and applications of isotopes to these fields. The summaries could save much time for radioisotope workers by quickly leading them to the more complete works which have been referenced for each application discussed.

This publication could serve well as a textbook for courses where otherwise trained individuals are familiarized with the utility of radioisotope technology to industrial applications. It is written in a manner also amenable to individual reading for those who cannot attend a supervised training program. Once read, it should serve as a valuable reference since it contains over 135 general technological references and over 530 references to work specifically mentioned in the text.

Summing up, this book is recommended reading for engineers and other industrial personnel desiring to acquaint themselves with what can be done with radioisotopes and how it is done.

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(About the Reviewer: J. P. Danforth is a senior research engineer with the General Motors Research Laboratories. He is engaged in development of industrial radioisotope applications, coordination of radiological training of engineering personnel, and direction of radiological safety and isotope control at the Research Isotope Laboratory in Warren, Michigan.)

Nuclear Radiation Measurement. By J. SHARPE. Nuclear Engineering Monograph. Simmons-Boardman, New York, 1960. 71 pp., $2.75.

The book is well printed in readable type. There are few typographical errors, if any. This volume of 71 pages contains 27 figures, 13 tables, and 54 references. The illustrations are well reproduced, all of them being line drawings. Spot-checked references were found to be correct. It was gratifying to note the large number of references, including many original references. The table of contents is rather brief, but there are adequate subheadings in each chapter. The editorial foreword states, "The writing style in this monograph is intended for university and technical college students, research assistants, and qualified technicians who require a broad understanding of those topics of nuclear engineering outside their own field of study." The writing is considered quite readable and useful at this and higher technical levels.

The author, J. Sharpe, has also written "Nuclear Radiation Detectors" (Methuen, London, 1955) and numerous papers on radiation detection. He is active as a developer and designer of photomultiplier tubes and radiation detecting instruments and is currently employed by EMI Electronics, Ltd. Mr. Sharpe is well qualified by virtue of his long experience and leadership in the field of radiation detectors.

Chapter 1 contains a compact one and one-half page summary of the following chapters, as well as distinguishing between the basic types of radiation detectors and the basic types of nuclear radiation. This brevity is indicative of the pace maintained throughout the rest of the book.

Chapter 2 deals with the Interaction of Radiation with Matter and is the longest portion of the book. From the standpoint of radiation detectors, Chapter 2 constitutes a good review, but achieves this by assuming a considerable

prior knowledge of atomic and nuclear physics. The reviewer was pleased to see the considerable quantity of useful information pertaining to scintillation phosphors and phototubes collected so compactly. An interesting reference is made in Table 4 to materials useful for solid ionization detectors, from which silicon is notably absent. Considering the date of the writing (the Preface is dated June 1959), this is an understandable defect, which is likely to be the fate of any contemporary work on radiation detection.

Chapter 3 is concerned with General Considerations on detectors. The ionization detectors are divided into track recorders, secondary emission detectors, and scintillation counters. Recent developments in track imaging systems are completely omitted. Spark counters are dismissed in one sentence as "of respectable antiquity . . . (but) no longer of practical importance." In 1961, spark counters are of quite practical importance in track imaging. The intent expressed in the Preface to "concentrate on the basic physical operation of the detectors" is admirable and, if followed, would have avoided the author's premature conclusion on spark counters. The information is generally presented in a very concise way, retaining the useful portions and omitting much unnecessary material often found in other volumes. In spite of the limited space, many useful side effects are described, such as the fact that "phototubes containing cesium will produce light in the region of highest current density (i.e., at the anode), which may in turn cause emission of photoelectrons from the cathode, finally resulting in an uncontrolled discharge."

The treatment of charge separation in an ion chamber, based on Fig. 9(a), may perhaps cause some confusion to the reader. The pulse shape shown is apparently taken at the output of an inverting amplifier and shown in the positive direction. While this is in keeping with the text, which says, ". . . the charge on the capacitance formed by the system has increased by q," the voltage pulse should be negative and the charge on the capacity decreased, being restored through the series resistor from the high voltage supply. The lucid description of the charge induction process at the anode of an ion chamber is quite gratifying and more than compensates for the error in sign. The reviewer wishes there had been further discussion of the Frisch grid ion chamber, including loss of resolution from the Fano factor.

In Chapter 4 on Ancillary Apparatus, we have again a fast tour through essentially all of the common types of amplifiers, pulse amplifiers, and discriminators, as well as some discussion of the anticoincidence and low background counting circuits. In discussing pulse amplifiers, the author touches briefly upon the difficulty of designing pulse amplifiers for ion chambers having pulses of approximately 5×10^{-15} coulombs: "This involves a circuit design which is inherently susceptible to microphony, if the full pulse shape is to be recorded . . . ." The reviewer regrets there was not room to explore this and other interesting observations.

Finally, Chapter 5 considers the Applications of Detectors for Specific Radiation. The treatment on gamma ray and x-ray detectors is particularly well presented.

Certain biases are apparent upon reading this monograph. There is emphasis on detector development in the United Kingdom, particularly in the field of health physics and engineering. Less attention is devoted to detectors for nuclear reactors and physics research.

In summary, this is a very worthwhile monograph as an introduction and reference because of the author's decision to "concentrate on the basic physical operation of the detectors." The venerable spark counter, which the author dismissed in one sentence as "no longer of practical importance," occupied significant space in *Rev. Sci. Instr.* **32,** No. 5, 480–531 (1961). The systems approach is only hinted at, as are some components of the large detector systems of modern physics. This monograph is admittedly a very condensed work, which is partly responsible for any shortcomings of the book, which the reviewer feels are largely beyond the control of the author. With the rapid development of radiation detection in the post-sputnik world, advances such as transistorized multichannel analyzers, silicon solid state charged particle detectors, and complex track imaging systems could each be the subject of other such monographs. Those who are working directly in the field of radiation detection will find this monograph a convenient reference because of its many tables, readable figures, and the references. The reviewer hopes that other such monographs on nuclear radiation measuring devices will be forthcoming.

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