There is a good combination of theory and application data in most of the papers from which the reader can obtain a good basic understanding of the fundamental radiation phenomena in such devices as diodes and transistors. Both transient and permanent radiation effects are discussed and the applicable mechanisms are also described. Formulas are given for the determination of the magnitude of these effects as a function of exposure to various forms of irradiation. Considerable data are included illustrating the effects of specific irradiations on certain transistor types. Since these articles were written on the period 1962 to 1963, the results do not necessarily represent potentialities of currently available transitors which possess greatly improved radiation resistance over the earlier devices. The basic mechanisms are still the same, however, and the fundamental theory can still be applied to the newer devices.

The reader who expects to be able to design radiation-hardened equipment based on the contents of this little book is going to be disappointed. It is more in the nature of a state-of-the-art resumé and guide for more detailed study. There is no index, but this is not a serious drawback in a book of this type. The one paper on radiation-hardened equipment design is little more than a description of the program, its objectives, and the results achieved, with little or no details as to the methods by which they were achieved.

There is considerable material on correlation between various forms of radiation. Nevertheless, as Dr. van Lint points out in his concluding comments, there is still room for a great deal of study before a consistent picture emerges. The need for such correlation is obvious, as the environment to which equipment is to be exposed is too often not reproducible in the laboratory. If results can be obtained from irradiation with x rays or readily available particles that can be shown to correlate reasonably well with the effects found in space environments for example, design and testing problems will be greatly simplified.

While there is a great profusion of information and data on radiation effects in the literature, its very mass complicates the problem of retrieval. Any extraction of the basic material from this mass is welcome. While this volume does not go very deeply into the subject, it still should provide a good basis for the designer who is becoming involved in the growing field of radiation environment. It is only an introduction, however, and a great deal of additional study will be required before one can predict the full effects of radiation environments on electronic equipment.

Richard F. Shea, a consulting electronics engineer, is well-recognized as an authority on circuit applications of transistors and other solid-state devices. He has authored or edited four textbooks on transistor circuitry since 1953. From 1937 to 1963 he was with the General Electric Company, where he was responsible for integrating the advances in electronics into the nuclear field, including application of transistors and other semiconductor devices into nuclear and process instrumentation at KAPL. His BS degree (electrical engineering) was granted by Massachusetts Institute of Technology in 1924.

SHORT OF COMPREHENSIVE

Title Handbook of Vacuum Physics

Vol. 1, Parts 1-3 Gases and Vacua $6.00 viii + 208
Vol. 2, Part 1 Physical Electronics $6.00 vii + 178
Vol. 3, Parts 1-3 Technology $6.00 viii + 191
Vol. 3, Part 4 Technology $3.00 viii + 270

Editor A. H. Beck

Publisher Pergamon

Reviewer John Strong

Editor Beck sets out to cover the essentials of the many different scientific disciplines involved in the use of vacuum apparatus, or in work on the diverse applications of high-vacuum technology in research or industry. The topics range from quantum theoretical aspects of solid-state, thermionic, and photoelectric physics, to commercially available pumps, gauges, and materials. This range is so great that it can be met only by a series of long articles, each prepared by an expert, giving an up-to-date survey of his subject.

These books do not constitute the whole of the material that will be published eventually. When the whole is published, it will be possible to issue binders to assemble it all into volumes as originally planned.

The books contain physics related to vacuum work, tables of properties of materials and of the performance of equipments that are commercially available, and practical procedures.

The work will serve as a most welcome guide to the literature for instruction on procedures, as a stimulant to ingenuity (substituting for visits to research laboratories, etc.), and as a kind of seed catalogue for planning. It is unfortunate for the reader that those whose wares are advertised had not participated fully enough, on the side of finance, to let the books sell inexpensively, as paperbacks should.

I find that the writing ranges through a spectrum, including categories suggesting that the author is an experienced experimental physicist, is an engineer—now become a busy manager, or is only a reporter of techniques. In any instance where this characterization might be taken as derogatory, it should apply to the physics, not the sentence structure, for meanings are rarely obscure. I found the exposition particularly clear in Morgan's Vol. 2, the part I am least qualified to judge scientifically. This is the only book that is indexed. Dayton's long article on the quantitative behaviorism of vacuum systems is excellent.

I was disappointed not to find some of my own pets, for example:

1. a recommendation for use of Koroseal tubing—it can be pushed onto glass tubes that are heated just above the plastic's melting point, to form a fused connection—a long length on a McLeod gauge can be

pinched off to demonstrate a sixfold smaller rate of pressure rise than that for an equivalent red-rubber vacuum hose—and the fact that it is immune to ozone;

2. the technique of mica splitting with water;

3. the strategy of short pumpdown time in instances involving thermal evaporation where some residual gas pressure is not deleterious, but where a lower pressure with greater oil-pump backstreaming is intolerable;

4. the virtues of "dry-ice" packs on the throat of a metal diffusion pump, as an effective trap or pump for vapors;

5. the high fluidity on melting, and the excellent strength of virgin indian shellac—the more often shellac is remelted, the more cheesy it gets;

6. heating by focused visible and/or infrared radiation, as for soldering;

7. thermally evaporated solder coats—as long ago as the beginning of World War II, my associate, J. Winget, and I put thermally evaporated adhesive silver films onto the polished flanges of a complex glass system for assembly with soft solder. This made a system bakable to well over 100° C, for outgassing. We also put such solder coats on the rims of the lenses for solder attachment to oximeters, for simplicity of gastight closure, etc.

These are some of the items that I had expected to find. Their absence inspired one to consider the topics treated as being short of comprehensive. Nevertheless, there are many new things assembled here. With the books yet to be published, the comprehensiveness of the coverage of vacuum physics and vacuum procedures will no doubt become substantially complete.

John Strong is Director of the Laboratory of Astrophysics and Physical Meteorology at Johns Hopkins University. He received his PhD in physics at the University of Michigan; served as a National Research Council Fellow, then Astrophysics Fellow, and finally Assistant Professor of Astrophysics at CIT; was a Research Fellow at Harvard; and is now Professor of Experimental Physics at The Johns Hopkins University. He has done research in crystal growing, thermal evaporation, and infrared spectroscopy, at Michigan, thermal evaporation, infrared spectroscopy, and astrophysics at Caltech, Harvard, and later at JHU. With a KBr prism that he made, he was the first to map the 15 μCO_2 band and resolve its lines. He developed, and was the first to use, thermal evaporation in this country. He was the first to produce aluminized surfaces—now common for sealed-beam automobile headlights— and applied this technique to astronomical mirrors.

HANDLING CREATIVE PEOPLE

Title Management for Research and Development

Author H. A. Collinson

Publisher Pitman, 1964

Pages vii + 131

Price 16/-net

Reviewer Walter H. Esselman

This book is an excellent addition to the library of anyone interested in the management of a research and development organization. The author reflects his experiences in the planning and execution of development programs. Since this experience was obtained in Great Britain, some of the terminology differs from that in common use in this country. The book is, however, interesting and easy to read.

Following an introductory chapter, which broadly presents the requisites of a good research and development manager, the author describes a set of techniques for improving the efficiency of a research and development department. The subject is treated according to classic principles of forecasting, planning, organization, coordination, command, and control. He emphasizes that the management of research and development reduces basically to the direction of people and, therefore, has much in common with the problems encountered in the management of other endeavors. For example, the technical manager can learn much from the methods used in the management of a production department, with the fundamental difference being the degree of predictability of both the schedule and quality of the results. The initial definition of a development program must be based upon the careful selection and planning of the projects. This selection process is carried out with the close collaboration of the other functions and must be directed toward achieving the forecasted goals of the organization. Decisions not to work on some intriguing projects are difficult, but essential to assure that reasonable attention can be applied to the selected ones.

This section is followed by a review of the methods of organizing a research and development effort. The author describes a functional organization that is working on many small- to relatively large-size projects. The project team approach, consisting of a team of highly skilled personnel drawn from an organization based on technical disciplines, is endorsed. A more complete discussion of the problems associated with this type of organization would have been of great value. For example, the selection of the team leader and the relationship of the project team to functional line management is a complex question fraught with many pitfalls. Very sound advice is given concerning the need for flexibility of organization and mobility of staff. The accelerated development programs prevalent today seem to require continual organizational updating to accommodate technical changes and completion of various phases of effort.

One of the most interesting chapters in the book describes the factors affecting the research and development worker's efficiency. The treatment of this subject shows the author's awareness of the importance of maintaining the proper morale and motivation of the research worker. The subjects covered include salary, status publications, encouragement, training, attendance at sci-