Crystal rectifiers. Henry C. Torrey and Charles A. Whitmer. (Ed. by S. A. Goudsmit, *et al.*) (Massachusetts Institute of Technology Radiation Laboratory Series.) New York-London: McGraw-Hill, 1948. Pp. xiii + 443. (Illustrated.) $6.00.

Under the sponsorship of the Office of Scientific Research and Development, members of the staff of the Radiation Laboratory of the Massachusetts Institute of Technology undertook the compilation of a series of books reviewing World War II research and development programs in which the Radiation Laboratory had been actively engaged. *Crystal rectifiers* is one of this series. The scope of the book is not restricted to Radiation Laboratory projects, and the attempt is to encompass all contemporary effort devoted to the development of crystal rectifiers during the war, including some information concerning related activities in England. It is to be assumed that all work was closely coordinated.

After indicating the renewed importance of the crystal rectifier since the development of microwave radar, the authors summarize the results of crystal rectifier development effort in the following words appearing in the preface of this book: "As a result, the crystal rectifier unit that has emerged is a compact, stable device which is superior in many applications to the vacuum tube diode. Its most extensive use up to now has been as a frequency converter in microwave reception, where its performance has not been equaled. It has also been used to a lesser extent as a low-level microwave detector."

The authors give very interesting discussions of the theory of conduction in semiconductors and of rectification at the contact between a metal and a semiconductor. Analytical studies involved the use of an admittance matrix in terms of signal, intermediate, and other frequencies. Effects of the nonlinear characteristics of crystal rectifiers are treated, although, as may be expected, the treatment becomes unwieldy and involved.

The book is well and carefully written. The very large amount of material is well arranged and makes interesting reading. The text covers the very interesting development aspects and manufacturing techniques, in addition to the theoretical and research work on crystal rectifiers. This book would be of interest to those engaged in microwave research and development in educational, governmental, commercial, and other institutions or agencies.

Most of the references are to reports made by wartime contractors, access to which may be found difficult in many cases. However, as the text appears to be very complete, this may not be a serious complaint. The value of the book might have been greatly improved had the authors attempted to give their appraisal of the most promising avenues for continued research in the field of crystal rectifiers. A perusal of the book indicates, for instance, that further analytical studies of the rectifiers from the point of view of quantum mechanics would be highly profitable and might conceivably be a means of contributing to our knowledge of the solid state.

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Powder metallurgy: its physics and production. Paul Schwarzkopf. New York: Macmillan, 1947. Pp. xii + 379. (Illustrated.) $8.00.

Powder metallurgy: its physics and productivity is an outstanding contribution to this field, covering as it does, all branches of this subject, including ferrous, nonferrous, highly porous and dense, friction hard metals, and refractories. The author is quite thorough.

In powder metallurgy the metal powders, or raw materials, are of primary importance. Frequently, they can be produced by various methods or processes, each of which are fully described. Particle characteristics and their influence are a major factor, and all of these are treated. Since copper powder and iron powder are used by industry in the largest volume, the genesis and behavior of these two materials have been especially emphasized.

From metal powders the reader progresses by logical steps, and in a very interesting manner, through the various subsequent operations in their natural sequence. Compacting, or briquetting, is outlined, as are the different types of briquetting presses and die sets. The die design and procedure for making both simple and complex briquettes or compacts is well illustrated.

Sintering methods and equipment are delineated along with the effects of temperature and time, particularly with reference to growth and physical values. Reducing atmospheres, their properties, control, and influence are described.

In the chapter on re-pressing or sizing, equipment, tooling, and the effect of normal variables, as well as their influence upon the end-product, including strength and ductility, are shown.

In powder metallurgy, porous units for self-lubrication or other service are desirable as well as units of high density for superior physical properties. Cognizance is taken of the fact that, for the latter group, different methods may be employed. All of these and attending factors are treated with respect to end-results.

Powder metallurgy products are unique in that some cannot be produced by any other methods, while others are in competition with solid or reguline materials. The latter is a relatively more recent development as compared to the manufacture of porous, self-lubricating bearings or hard-metal cutting tools. Special processing is involved, and these as well as the effect are fully described and illustrated. The production of hard metals, friction members, and such specialties as contact points, radio cores, and magnets is fully covered.

The author's style inspires confidence, and throughout the book an unusual mixture of practice and theory is presented in a coherent manner. Schwarzkopf devotes considerable space to the purely theoretical aspect of powder metallurgy, and here, too, there is an infiltration of the practical. The book is replete with informative charts, data, photos, references, and bibliography. Theories advanced by other authors, principally on sintering and compacting, are stated clearly and accurately. In a charming manner, the author credits early investigators, other works, contributors, and colleagues.

This book is excellent indeed and well suited for engi-