VI B compounds. There are large sections dealing with complexes containing chelating ligands with oxygen, nitrogen, and sulfur bonds. While most of these subjects are not of particular importance by themselves, they do form a coherent picture of the chemistry of these elements when viewed together. A very useful appendix gives in detail methods of preparation for many of the most useful complexes.

The organometallic complexes of platinum and palladium are the subjects of another significant section. Molecular structure of these complexes is the major concern of the chapter, although reactions and reaction mechanisms are adequately covered as well. Mechanisms of the commercially important catalytic reactions such as the Wacker acetaldehyde process are also discussed.

This volume will be of the most value to the research worker in this field of chemistry. Students and teachers will also find much of value, especially in the sections illustrating how minor changes in structure affect bond lengths, angles, and spectra.

RICHARD HECK
Department of Chemistry,
University of Delaware,
Newark

Materials and Applications

The Science and Technology of Superconductivity. Proceedings of a course, Washington, D.C., Aug. 1971. W. D. GREGORY, W. N. MATHEWS, JR., and E. A. EDELSACK, Eds. Plenum, New York, 1973. Two volumes. Vol. 1, x pp. + pp. 1–432, illus. Vol. 2, xii pp. + pp. 433–816, illus. Each volume, $22.50.

In 1971, a summer course on superconductivity was given at Georgetown University by 25 invited speakers. They have set forth the course material in this book. Volume 1 consists of two parts with approximately equal length. The first part is an introduction to the basic thermodynamic and electromagnetic properties of superconductors, the theoretical background, and refrigeration. The second part is a description of superconducting materials. Volume 2 is devoted to technological applications and a summary of the course. The book as a whole provides a comprehensive and authoritative view of the subject. The main emphasis is on materials and applications; for the most part, the fundamental scientific aspects are presented by the various authors only to the extent necessary to explain the technology, to which most of the present research work on superconductivity is now being devoted.

The general reader will be interested in the wide range of applications which are described in detail. These include the measurement of voltages as small as 10^{-16} volt or magnetic fields as small as 10^{-11} gauss by tiny devices. The detection of very small magnetic fields enables one to observe electrical currents in the human heart or brain or to search for weakly magnetic materials in the ground. Large-scale applications of superconductivity include the construction of giant superconducting coils to create magnetic fields in excess of 5×10^4 gauss in large regions of space for generating power by nuclear fusion or for magnetically supporting high-velocity intercity trains. It is expected that superconducting transmission lines will be built in the 1980's for handling very large power loads, in excess of 10^9 watts. Many of the most fascinating applications are based on the Josephson effect, which accompanies the passage of electrons from one superconductor to a nearby one through a thin barrier or weak link. This effect is being used to develop revolutionary ways of storing information in computers and of gathering, modulating, and detecting electromagnetic signals.

The first five chapters of the book present the three types of superconductivity theories. These types are phenomenological, quantum mechanical, and advanced quantum statistical. All of them have played a vital role in the history of the subject, and they are all still useful in thinking about superconducting phenomena and in doing calculations. Among the phenomenological theories discussed is that of Ginzburg and Landau (1950). Its general methods were used and extended by Josephson (1962) to predict the effect which now bears his name. The theory of Bardeen, Cooper, and Schrieffer (1957), for which the Nobel Prize was awarded last year, is of the second type, quantum mechanical. The theory provided a foundation for the phenomenological theories and enabled their limitations to be explored. It also made possible the development of theories of the third type, advanced quantum statistical. These employ so-called thermodynamic Green's functions. A detailed account of them takes up almost 50 pages of chapter 3 in the book, but the average reader will find this material far too subtle and abstract to comprehend. He may if he wishes skip over it; although theories of the third type have been of vital interest to researchers in the field of superconductivity, they are not at all necessary for understanding the book's other chapters.

Of particular interest to this reviewer is an unusual chapter by R. A. Hein. It describes in a balanced and thorough way the history of empirical rules which have led to the gradual development of materials which are superconducting at ever higher temperatures and in ever larger magnetic fields. This technologically crucial process was carried out by many people, in particular by B. T. Matthias and his co-workers. The empirical rules involve the average number of conduction electrons per atom, crystal structure, atomic volume, lattice parameter, melting point, electropositivity, electronic density of states, Hall coefficient, and stoichiometric and crystallographic perfection. Hein describes how the rules were discovered and how some of them had to be altered or discarded as more materials were investigated.

Among the many other chapters which should be of wide interest is one by T. F. Finnegan, in which he describes in detail the development and operation of a new voltage standard, based on the Josephson effect, which now has replaced the standard cell as the nation's standard of the volt. The technological implications of superconductivity in the next decade are summed up in a chapter by D. N. Langenberg.

The book contains a transcription of a panel discussion among the authors. The main topic considered is the role of theory, new materials, and inspired guesswork in making technological advances. The panel members also talked about the large effort which is required to develop a practical device from a technologically sound idea. Some of the panel members felt that applied superconductivity is being pursued more vigorously in Europe than in the United States.

The book is very legible. It contains approximately 280 figures and 625 references, an author index, and a good subject index. It should be of interest to any reader who wants a glimpse of some of the technology of tomorrow.

D. M. GINSBERG
Department of Physics and
Materials Research Laboratory,
University of Illinois, Urbana