Advances in superconductivity

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High-temperature superconductivity is one of the most interesting problems in physics today. This field has produced a number of specialized conferences and a multitude of collections of original and review articles, conference proceedings, etc. The latter include the book under review—a collection of materials presented at the international seminar on superconductivity that was held in Nagoya in August of 1988. This ample volume (almost 1000 large-format pages) contains contributions on both the physical and technological aspects of superconductivity, as well as possible applications, mostly of high-temperature superconductivity (HTSC).

At the current pace of HTSC research, the results reported at such conferences are often superseded by new developments by the time of publication. To some extent this is true of the book under review. Nonetheless, because of the high level of a number of contributions and their broad scope—from fundamental physics, to purely applied reports, including technological details and discussion of scientific policy with regard to HTSC—this book could be of considerable interest to many readers.

Obviously a brief review cannot discuss all the material collected in the book. For this reason we will cite the headings of its main sections, which should give the reader some idea about the contents.

The book opens with a rather interesting general introduction that describes the history of superconductivity, from its discovery in 1911 right up to the recent discovery of high-temperature superconductors. The introduction is followed by Section 1, "Prospects for Applications of Superconductivity," which focuses on the general features of superconductor applications. The technological applications, both existing and currently under development, include methods of generating, transmitting, and storing electricity, superconducting magnets, electronics, etc. This section is in no way restricted to HTSC, but rather discusses all types of superconductors.

The next, relatively small section (two papers) covers organic superconductors. This is followed by Section 4 which covers oxide superconductors and comprises practically 90% of the entire volume. Section 4 is subdivided in 15 chapters: mechanisms of superconductivity; crystal chemistry and electronic structure; phase diagrams and crystal growth; processing and microstructure; tapes and thick films; wires and coils; coherence length, magnetic properties, and critical current; irradiation effect; thin film processing and properties (parts I and II); chemical reactions and the superconductor-substrate interaction; devices and applications; tunneling and tunneling junction; Bi- and Tl-based cuprate superconductors; 110 K phase of Bi-Sr-Ca-Cu-O fabrication and microstructure.

Finally, Section 5, "Research policy and technology trends," describes the organization of HTSC research in the UK. A short section of concluding remarks, summarizing the main results presented at the symposium together with some problems, brings the volume to an end.

From the above contents it is clear that unlike most collections and conference proceedings, this book devotes a fair amount of space to material science aspects of HTSC, sample fabrication, fabrication of "working" wires, tapes, films, etc. In my opinion, this is the material that will be of greatest value to the reader, although the contributions on the fundamental properties of HTSC certainly contain some interesting material as well.

Translated by A. Zaslavsky