ISTEC, MRS Hold Superconductivity Workshop in Hawaii

The First International Superconductivity Workshop, co-sponsored by the International Superconductivity Technology Center (ISTEC) and MRS, was held June 23rd through 26th at the Hilton Hawaiian Village Hotel in Honolulu, Hawaii. The theme of the workshop was "Crystal Growth and Processing of High T_c Superconductors." Extensive and lively exchanges on mechanisms of oxide crystal growth and applications to wire materials characterized the meeting. Participants numbered 178 and came from 12 countries, principally from Japan, the United States, and European countries.

The first day began under the chairmanship of ISTEC Director K. Shibasaki and was highlighted by the opening address of ISTEC Managing Director S. Tanaka, who also delivered a special lecture titled "Future Technologies and Superconductivity." This was followed by a special lecture from C.W. Chu (University of Houston) titled "Bulk Application of High T_c Superconductors." S. Tanaka emphasized that the future key technology for superconductivity was the growth of fine-quality single crystals, and cited the history of semiconductor and molecular biology research as examples. C.W. Chu emphasized that the bulk application of high T_c superconductors required not only J_c, cross-sectional area, and length of bulk materials, but also mechanical strength and other factors. He included a presentation of some recent research results from the Texas Center for Superconductivity at the University of Houston.

In the plenary session that followed, F. Holtzberg of IBM, Y. Hidaka of NTT, and M.C. Flemings of MIT delivered overviews on the present state of technology and understanding for single-crystal growth, phase diagrams, and unidirectional solidification processes. The next presentation, by D.G. Schlom of Stanford University on superconductive thin film epitaxy from the gas phase, included a special emphasis on the importance of screw dislocations to the growth mechanism.

In addition, P.H. Hor of the University of Houston and K. Togano of National Research Institute for Metals introduced, respectively, the present state of yttrium-123 unidirectional solidification and of bismuth-based wire forming. They explained that these technologies had advanced to within "an inch" of actual applications.

Each of the next set of sessions dealt with specific material systems, i.e., the 1-2-3 system, the bismuth-based system, and the thallium-based system and other materials. In all these sessions, animated discussions occurred on the present state of phase diagram research, technology for growing single crystals, technology for epitaxy from the gas phase, methods to control multicrystal growth, and mechanisms of crystal growth. Those discussions focused on the effect of oxygen partial pressure on the phase diagram and growth mechanism and on whether the mode of growth was layer-by-layer or three-dimensional. The problems brought up in these sessions were later examined in detail from both fundamental and applications perspectives in two parallel group discussions: "fundamentals of crystal growth" and "application of high T_c superconducting materials."

Figure 1. C.W. (Paul) Chu of Texas Center for Superconductivity at the University of Houston giving a Special Opening Lecture.

Figure 2. Shoji Tanaka, vice president of ISTEC, giving a Special Opening Lecture.

On the second evening, rump sessions were held on "the size and perfection of crystals" and "the introduction of pinning centers." Rather informal but quite intense discussions treated these subjects. Reports were made on the most recent preparation results for large single crystals and on substantial progress in understanding how to introduce pinning. For example, presentations by T. Wolf of KfK on the method of preparing fine-quality huge single crystals and by D.L. Kaiser of NIST on the effect of various dopings on single crystals engendered considerable discussion.

On the final day, "Rump Awards" were presented by the chairs of the Workshop Program Committee for the two categories of largest crystal and highest-performance wire. These awards had no official standing, but were presented in a light-hearted vein as encouragement to researchers engaged in single-crystal growth and wire development.

Gold Certificates in the single crystal field were awarded to the 8 to 10 cm^2 crystals of S.W. Cheong of AT&T Bell Laboratories for the lanthanum system; to 2×3 cm^2 crystals of T. Wolf of KfK and to 7-mm crystals in c-axis direction of Y. Yamada of ISTEC for the yttrium system; and to 5×1 cm^2 2212 crystals of K. Kitahama of Osaka University for the bismuth system. While the Bi-system single crystals were made by the float-zone method, both S.W. Cheong's La-system crystals and T. Wolf's Y-system crystals were made by the flux method. ISTEC's Y-system crystals, grown by pulling from the melt, also indicate a promising approach for fine-quality single crystals. Other groups also presented individual crystals and were awarded Silver Certificates.

For high-performance wire, Silver Certificates were awarded to all companies that entered, in recognition of their tremendous effort and proven advances, but with the consideration that actual applications still remain at least a step away. The entries came from the laboratories of Sumitomo Electric Industries, Ltd., National Research Institute for Metals, Furukawa Electric Co., Ltd., Fujikura, Ltd., and Hitachi Cable, Ltd.

A poster session comprising more than 80 contributions occupied midday of the

Figure 3. R.P.H. Chang of Northwestern University, president of the International Union of Materials Research Societies, chairing the Special Opening Lecture Session.

Figure 4. Merton Flemings (left) of MIT chatting during a break with Yu Shiohara, director of Division IV at ISTEC's Superconductivity Research Laboratory.

Figure 5. Tomoji Kawai (right) of Osaka University and Elton Kaufmann of Argonne National Laboratory, Workshop Program Committee chairs, discussing last minute program adjustments on the eve of the workshop.

second workshop day. Single crystals, thin films, phase diagrams, polycrystals, melting, solidification, pinning, T_c, and many more aspects of superconductivity were covered. We were most impressed by the enthusiasm of participants, who continued through the lunch hour with tireless discussions at the posters, despite the temptation of Hawaii's blue sea and sky.

On the final day, presentations were made by representative groups of Japan and the United States on the progress of superconducting wire applications. It was our impression that the Bi-system was coming close to actual application as wire conductors. Each group showed specific accomplishments such as a wire exceeding 100 m in length and a high-performance wire to be used in high magnetic field at 4.2 K. We also noted that fine-quality yttrium-123 bulk material was being produced by unidirectional solidification.

Although this was the first jointly organized symposium of ISTEC and MRS, the conference logistics were well-prepared and the administrative support during more than 18 months of planning went very smoothly—thanks, in great measure, to ISTEC's secretariat. We are also grateful to the following organizations who supported the meeting: The Japan Keirin Association, The Texas Center for Superconductivity at University of Houston, The NSF Science and Technology Center for Superconductivity, Argonne National Laboratory, Los Alamos National Laboratory, Oak Ridge National Laboratory, and The New York State Institute for Superconductivity. Finally, we are indebted to all participants, whose combined contributions added up to an extremely worthwhile workshop. Despite the narrow emphasis of this symposium on superconductor crystal growth, our expectation was confirmed that fine-quality high-T_c copper-oxide superconductors in any form are broadly dependent on appropriately controlling the crystal growth. □

Tomoji Kawai and
Elton N. Kaufmann,
Program Chairs

License to exceed normal limits

Zirconia Fiber-Based Materials offer limitless possibilities

When you need exceptionally high temperatures, low thermal conductivity or resistance to chemical attack, choose one of Zircar's Zirconia fiber-based materials. Bulk fibers, flexible textiles, rigid boards or cylinders: nobody knows how to take Zirconia to the limit like Zircar!

Zircar FIBROUS CERAMICS
P.O. Box 458, Florida, NY 10921
Tel: (914) 651-4481 Fax: (914) 651-3192

Circle No. 39 on Reader Service Card.