Preface

This Proceedings contains most of the papers presented at the E-MRS Symposium A "High Temperature Superconductors", one of the five parallel Symposia of the 3rd European East-West Conference and Exhibition on Materials and Processes, E-MRS-Mat. Tech.- f.e.m.s. Joint Conference, held at the Council of Europe and European Parliament in Strasbourg (France), 3-6 November1992.

200 scientists from 20 countries attended this Symposium A; 20 invited talks, 37 contributed papers and 200 posters reflected the progress on HTS. The first goal of the E-MRS Conferences is to promote communication between the countries of the European community. This year, the 5th Fall Meeting of the E-MRS was especially devoted to bring eastern and western countries together.

The sessions reflected a wide range of progress in materials development (single crystals, ceramics, thin films, wires and tapes) and were generally focused on achieving a better understanding of the relationship between microstructure and electrical properties. Invited papers covered the effects of substitution and doping, multilayers, nanostructure characterisation, electric field effects in HTS, surface stability, critical currents, flux pinning and magnetooptic imaging of flux patterns, effects of irradiation induced defects, properties and preparation of materials, microwave properties and electronic devices.

The Conference started with an excellent plenary talk by J. Mannhart devoted to application prospects in HTS covering both applications in electronics and power engineering The first promising applications are expected to be in microwave devices and in fault current limiters for energy transmission systems.Much progress has been made in the development of demonstrators and practical devices. An exciting contribution was the demonstration of the electric field effect in HTS, which enables that carrier density and thus the transport properties, to be directly influenced by application of an electric voltage.

The quality and reproducibility of YBCO films could be markedly increased by systematic studies covering both a good sample statistics and different preparation processes. Thereby, oxygen content and disorder in the CuO chains severely affect the film properties. With respect to microwave applications of thin film devices (antennas, resonators, etc.) the surface resistances are suitable for promising applications at 77K.

Progress was also demonstrated in YBCO active devices such as Josephson Junctions and SQUIDS. Remarkable improvements have been obtained for the noise performance of SQUIDS during the last year. Reproducibility is good for SNS and grain boundary junctions, however, it has to be improved for step-edge junctions.

A lot of careful microstructural analysis was presented (STEM, TEM, AES) to explore the morphology, defects and growth mechanisms of thin films on different substrates used in thin film technology. Growth of YBCO films was studied on a scale of an elementary cell using insitu high energy electron diffraction (RHEED) in combination with STM. It was demonstrated that RHEED intensity oscillations are an excellent tool, both for monitoring the growth of smooth films and for understanding formation mechanism of typical defect configurations like screw dislocations.

Whereas the involvement of the industry with HTS electronics is not so intensive at the moment, the expected turnovers for applications in power engineering may stimulate support to a greater extend. A critical current density j_c= 40 kA/cm^2 was reported at the conference for the promising 2223 BiPbSrCaCuO Ag-tape conductor made by the powder-in-tube technique. At the moment, progress is low, world-wide. Crucial points are homogeneity of j_c over longer length and the large influence of thermally activated processes at 77K. Better mechanical properties of the wires can be provided by introducing high-strength sheath-materials, such as Ag-Mg. Melt-textured 123 YBCO bulk material processed by equilibrium melting shows promising critical current densities near 10^5 A/cm^2, even in high fields. However, materials processing requires production speeds of several mm/h due to the slow back-reaction of 123 phase during cool-down across the peritectic transition. These methods are limited to permanent magnet applications such as magnetic bearings in flywheels for storing of mechanical energy.

The understanding of flux line pinning mechanisms has improved, especially in BSCCO compounds exhibiting high superconducting anisotropy. A lot of work was presented favouring the model of weakly coupled pancake vortices, supported by transport measurements on multilayers, by vibrating reed studies on single crystals and by irradiation experiments.

To summarize, the contributions have provided to a clearly broadened basis for understanding processes and mechanisms in HTS. Appreciable progress has been achieved in the reproducible manufacturing of high quality materials supported by very efficient methods in microstructural analysis. This essential improvement is reflected in the increased number of practical devices encouraging use of HTS in applications for electronics and power engineering.

The Editors

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