TT 2 Superconductivity: Conductor Development

Time: Monday 11:30–13:00 Room: HSZ 02

TT 2.1 Mon 11:30 HSZ 02

First technical applications for thin MgB_2 superconducting wires — •Wilfried Goldacker, Sonja Schlachter, Bing Liu, and Bernhard Obst — Forschungszentrum Karlsruhe , P.O.Box 3640, 76021 Karlsruhe

Although superconducting wires of MgB_2 are still in an early stage of development, a row of appliactions are already in the focus. Due to the request for very thin MgB_2 wires for the application in the satellite (current lead application) and the liquid hydrogene technology (level meter), thin MgB_2 monofilamentary wires with application specific properties, as low thermal conductivity or high mechanical strength were developed, and in the case of a saellite already applied. These thin wires with diameters down to 50 microns can be regarded as a finite element for the requested multifilamentary superconducting wires. We present results about transport critical current densities of optimized composites, the achieved thermal stabilisation of the conductor upon quench and the possibilities of mechanical reinforcements.

TT 2.2 Mon 11:45 HSZ 02

Transport Properties of Grains and Low Angle Grain Boundaries in $Y_{1-x}Ca_xBa_2Cu_3O_{7-\delta}$ — •Christof Schneider, Alexander Weber, Stefan Hembacher, Christian Schiller, Arno Kampf, Thilo Kopp, and Jochen Mannhart — Lehrstuhl für Experimentalphysik VI, Institut für Physik, Universität Augsburg, D-86135 Augsburg

One possibility to optimize for cable applications the critical current density of $YBa_2Cu_3O_{7-\delta}$ is to partially substitute Y^{3+} by Ca^{2+}. To systematically investigate the effects of Ca-doping on the transport properties of low angle grain boundaries, we prepared a set of $Y_{1-x}Ca_xBa_2Cu_3O_{7-\delta}$ ($0 \leq x \leq 0.3$) thin films on monocrystalline and bicrystalline $SrTiO_3$. Characteristic trends are revealed by the $J_c(B,T)$-dependencies. The dependencies are in part highly surprising as will be presented and discussed.

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TT 2.3 Mon 12:00 HSZ 02

Grain boundaries in REBaCuO (RE=Er,Y,Yb) Ca-doped YBaCuO thin films: Mechanisms of current suppression and current enhancement — •Christian Jooss[1], Karsten Guth[2], Yimei Zhu[3], and Felip Sandiumenge[4] — [1]Institute of Materials Physics, University of Goettingen, Germany — [2]EUPEC GmbH — [3]Brookhaven National Laboratory, Upton NY 11973, USA — [4]CSIC, Universitat Autonoma de Barcelona, Spain

Recent results on low-angle grain boundaries in high-temperature superconductors give fascinating insight into their interplay of atomic structure, electronic properties and transport properties [1,2]. It was shown that Ca doping can reduce atomic strain and the related size of space charge layers and therefore can significantly improve the transport properties in a wide angular range. However, our experimental data suggests that this mechanism does not work for all types of grain boundaries. Furthermore, we present experiments on ErBaCuO and YbBaCuO bicrystalline films, where charge balance arguments suggests an increased hole density in the electronic conduction bands and, in the framework of specific models, an increased critical current density. The different types of experiments will be summarized to determine the atomic mechanism determining the grain boundary transport properties. [1] R. F. Klie, J. P. Buban, M. Varela, A. Franceschetti, C. Jooss, Y. Zhu, N. D. Browning, S. T. Pantelides, S. J. Pennycook, Nature 435 (2005) 475. [2] M. A. Schofield, M. Beleggia, Y. Zhu, K. Guth, Ch. Jooss, Phys. Rev. Lett. 92 (2004) 195502

TT 2.4 Mon 12:15 HSZ 02

Growth of thick high critical current $YBa_2Cu_3O_7$ films with Y_2O_3 nano-inclusions by HLPE — •Judith MacManus-Driscoll and Ahmed Kursumovic — Department of Materials Science and Metallurgy, University of Cambridge, Cambridge CB2 3QZ, UK

Liquid-mediated growth of $YBa_2Cu_3O_7$ has the potential to be high rate and low cost. However, the reported critical current densities (J_c) are generally lower than for films deposited by physical vapor deposition processes. We report the deposition of thick high-J_c films (>1 $MAcm^{-2}$ in self-field in 3 micron thick films) on (001) $SrTiO_3$ by high-rate hybrid liquid phase epitaxy (HLPE). In brief, HLPE involves deposition of a thin liquid flux layer, followed by introduction of YBCO to the layer from a vapour or particulate source. The high Y supersaturation achieved in the BaO-CuO flux made nucleation and growth of coherent, nano-sized Y_2O_3 possible. These particles are an additional source of flux pinning, and can explain the enhanced J_c observed in the lower field regime compared to standard PLD samples. Angular-dependent transport critical current measurements as a function of applied field are presented, as well as microstructural measurements by transmission electron microscopy.

TT 2.5 Mon 12:30 HSZ 02

Development of coated conductors with an elongated grain structure — •R. Hühne, J. Eickemeyer, D. Selbmann, J. Hänisch, L. Schultz, and B. Holzapfel — IFW Dresden, P.O. Box 270116, D-01171 Dresden, Germany

The critical current density in RABiTS based coated conductors is limited by the network of small angle grain boundaries up to a texture dependent crossover field. However, YBCO layers with high aspect ratio grains should enable a more effective current transport due to an improved weak link behaviour at the elongated grain boundaries. Recently, cube textured substrates with an elongated grain structure were successfully prepared by specific processing of nickel tapes microalloyed with silver. The aspect ratio of the grains in these tapes was increased from about one to about four. Additionally, epitaxial NiO layers were grown a first buffer on the Ni-Ag substrate using surface oxidation epitaxy (SOE) resulting in a similar texture quality like the tape itself. YBCO layers were prepared afterwards by pulsed laser deposition on the Ni as well as on the NiO using a suitable buffer system. Inductive measurements revealed critical temperatures above 87 K and critical current densities J_c up to 1.6 MA/cm^2 at 77 K in zero magnetic field. The anisotropic current transport mechanism was experimentally proven in resistive measurements showing higher J_c-values along the grain elongation compared to the transverse direction.

TT 2.6 Mon 12:45 HSZ 02

Reel to Reel MOCVD of YBCO and buffer layers on textured metal tapes — •Oliver Stadel[1], Sergej Samoilenkov[1], Jürgen Schmidt[1], Ruslan Muydinov[1], Hartmut Keune[1], Georg Wahl[1], Oleg Gorbenko[2], Oleg Melnikov[2], Igor Korsakov[2], and Andrey Kaul[2] — [1]Institute of Surface Technology (IOT), Technical University Braunschweig, Bienroder Weg 53, 38108 Braunschweig, Germany — [2]Department of Chemistry, Moscow State University V 234, Moscow 119 899, Russia

We report the deposition of YBCO and oxide buffer layers on textured Ni tapes. We developed a new MOCVD technique for the deposition of epitaxial oxides on textured metal tapes. The oxygen partial pressure is controlled, so no NiO formation can take place, while the oxide buffer layer is stable. This enable us to coat the textured metal tape with conductive and isolating oxides. A RTR MOCVD-system was used to coat textured metal tapes with oxide buffer layers and YBCO layers. These YBCO films were in plane and out of plane textured with FWHM 5-6° and 1,5-3° respectively. Additional textured Ni-tapes, which were buffered and delivered from partners of the German Virtual Institute, were coated with YBCO (jc > 1 MA/cm2 at 77 K).

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