To achieve high current carrying capabilities in YBCO coated conductors based on cube textured metal substrates, the texture and stability of the buffer/metal interface is a necessary requirement. In this work cube textured Ni-4at.%W substrate tapes were subjected to different H_2S treatments and the texture development of post-deposited MgO buffer layers was studied. The in-plane orientation and the texture sharpness of the MgO layers was found to depend strongly on the heat treatment time in Ar-10 ppm H_2S. Increasing the time from 5 to 60 min at 800°C changes the in-plane orientation from 45° over 0° to 45° at 15 min and the texture sharpens continuously to an FWHM (220) of < 6°.

TT 7.14 Mon 14:00 P1

Physical properties of chemically deposited $La_2Zr_2O_7$ and CeO_2 buffer layers on cube textured Ni-4 at.% W substrates — •Gunter Kotzyba, Bernhard Obst, Rainer Nast, and Wilfried Goldacker — Forschungszentrum Karlsruhe, Institut für Technische Physik, P.O. Box 3640, 76021 Karlsruhe

The chemical solution deposition route for YBCO-coated conductors is of interest as a promising way to develop a low cost conductor. Thin films of $La_2Zr_2O_7$ and CeO_2 were prepared on Ni-4 at.% W by dip coating. The layers serve as buffer for depositing superconducting YBCO on top of it. We systematically investigated the dependence of the thickness on the viscosity and the concentration of the La (III) and Ce (IV) precursor solutions by means of a cone plate rheometer and an ICP OES. The roughness was analysed with a profilometer, the thickness determination was done by X-ray microanalysis. EBSD mappings show very good cube in-plane and out-of-plane texture.

TT 7.15 Mon 14:00 P1

dc and rf transport in normal and superconducting HTS, MgB_2, and Nb networks — •Jürgen Halbritter — Forschungszentrum Karlsruhe, Postfach 36 40

Island/grain boundaries occur naturally in film growth or sintering. The hindrance of electric transport by boundary resistances $R_{bn}(Wcm^2)$ in distances $a_J(\leq 10mm)$ is easy to measure in normal conducting transport in such granular networks. The resistivity $r(T) = R_{bn}/a_J + p(\rho^i(T) + \rho^i(0))$ is fitted to observations with percolation factors $p > 1$ by current diverting $a_J\rho^i(300K)$ boundaries with $R_{bn} \geq a_J\rho^i(300K)$ where $\rho^i(T) + \rho^i(0)$ is due to the grain interior (IG) and R_{bn}/a_J and p describes the effects of boundaries (GB) and the network. In the superconducting transport GB may act as Josephson junctions (JJ) with $j_{cJ}(A/cm^2)$ as current density. For superconducting networks is a simple separation in IG and GB not possible. But low I_c values, $p > 1$ and large R_{bn} values are clear indications for growth boundary limitations. Analysis of $I_c(T, B, q, \omega)$ as junction of temperature, field B, angle q and frequency ω give crucial information about GB and flux low or pinning of Josephson (JF) or Abrikosov fluxons (AF) in the network. The combination of normal and superconducting analysis is of crucial importance for dc, ac and rf engineering applications and for the understanding of the related material science.

TT 7.16 Mon 14:00 P1

Electronic structure calculations for YBCO/metal interfaces — •Udo Schwingenschlögl and Cosima Schuster — Institut für Physik, Universität Augsburg, 86135 Augsburg

Transport properties of heterostructures consisting of a metal and a correlated superconductor are of great importance for electronic devices based on HTSC. Using electronic structure calulations within density functional theory and the local density approximation, we investigate YBCO/metal interfaces. As the lattice mismatch between YBCO and Pd is rather small (0.7%), we choose Pd as the metallic constituent. It is generally accepted that the carrier density is modified at grain boundaries. Since this band bending should take place on the length scale of the lattice constant it can be reproduced by LDA supercell calculations. In particular, we use a supercell consisting of two YBCO unit cells alternating with five Pd layers along the orthorhombic c-axis. Following experimental results, the YBCO layers entering our calculations terminate by CuO chains.

Our results show that the electronic density of states at the interface depends crucially on the details of the local atomic structure. Therefore we have relaxed the atomic positions to minimize the forces on the ions. We compare two possible interface geometries, where the Pd atoms are placed on the Cu or O atoms of the CuO chains, respectively. For these configurations we determine the charge distribution across the interface.

TT 7.17 Mon 14:00 P1

Characterization of Top-Seeded Melt-Grown Bulk Superconductors by Hall Probe Mapping Techniques — •S. Haindl[1], H.W. Weber[1], N. Hari Babu[2], D. A. Cardwell[2], S. Meslin[3], J. Noudem[3], L. Shlyk[4], and G. Krabbes[4] — [1]Atomic Institute of the Austrian Universities, TU Vienna, Austria — [2]IRC in Superconductivity, University of Cambridge, UK — [3]CRISMAT-ENSICAEN, CNRS/UMR, France — [4]IFW Dresden, Germany

We report on the characterization of top-seeded melt-grown (TSMG) single grain bulk superconductors by two Hall probe mapping techniques. Scanning the trapped field distribution following magnetization of the sample in an external field is an established method of characterizing these materials. This technique enables both determination of the maximum trapped field after complete field penetration of the bulk sample, and identification of growth-induced inhomogeneities within the sample microstructure. A new mapping technique known as Magnetoscan has been developed over the past two years and recently improved to yield more useful information about the quality of bulk superconductors. This technique involves scanning simultaneously a small permanent magnet and a Hall probe over the unmagnetized superconducting surface of the bulk sample. Interesting results have been obtained using the magnetoscan technique, including direct imaging of different growth sectors in bulk samples and the identification of inhomogeneities such as cracks and grain-boundaries and the mapping of artificial holes in the single grain microstructure.

TT 7.18 Mon 14:00 P1

Nanometer-scale superconducting domains observed on $NdBa_2Cu_3O_{7-\delta}$ — •Pintu Das[1], Dirk Mautes[1], Michael R. Koblischka[1], Thomas Wolf[2], and Uwe Hartmann[1] — [1]Institute of Experimental Physics, University of Saarbruecken, D-66041 Saarbruecken, Germany — [2]Forschungzentrum Karlsruhe GmbH, Instiitute of Solid State Physics, D-76021 Karlsruhe, Germany

In understanding high temperature superconductivity, the recent focus is at the local-scale electronic modulation and its influence towards superconductivity in general. The granular structure and atomic-scale modulation of the density of states in $Bi_2Sr_2CaCu_2O_{8+\delta}$ have been observed [1,2]. Here we report Scanning Tunneling Spectroscopic (STS) results obtained on the (ab) plane of a slightly underdoped $NdBa_2Cu_3O_{7-\delta}$ (T_c= 93.5 K) twinned single crystals at 4.2 K. Recent results proved that the NdBCO surface is highly clean and stable in air, showing atomic resolution at room temperature [3]. We used the STS imaging technique to study the electronic inhomogeneity and we observe that there are superconducting domains of ~ 3 nm length scale separated by nonsuperconducting regions, similar to that observed in $Bi_2Sr_2CaCu_2O_{8+\delta}$. In the superconducting domains, the size of the energy gap spatially varies from ~ 16 meV to ~ 44 meV. The average gap size is found to be ~ 22 meV. We discuss these data and the possible origin of the inhomogeneous electronic structure of the respective materials.

[1] Lang et al., Nature 415, 412 (2002)
[2] McElroy et al., Nature 422, 592 (2003)
[3] Ting et al., Appl. Phys. Lett. 72, 2035 (1998)

TT 7.19 Mon 14:00 P1

Nanoscale stripe structures in $SmBa_2Cu_3O_x$ superconductors — •M. Winter[1], M. R. Koblischka[1], Th. Wolf[2], X. Yao[3], A. Hu[4], and U. Hartmann[1] — [1]Institute of Experimental Physics, University of Saarbrücken, P.O.Box 151150, 66041 Saarbrücken, Germany — [2]Forschungzentrum Karlsruhe GmbH, Institute of Solid State Physics, D-76021, Karlsruhe, Germany — [3]Department of Physics, Shanghai Jiao Tong University, 1954 Huashan Road, Shanghai 200030, P. R. China — [4]Department of Physics, University of Waterloo, 200 Univ. Ave. West, Waterloo, ON N2L 3P7, Canada

AFM and STM scans on $SmBa_2Cu_3O_x$ (SmBCO) melt-processed samples prepared using different techniques revealed the presence of nanoscale stripe-like structures, sometimes parallel over several micrometers, sometimes wavy. These structures consist of chemical compositional fluctuations and act as effective δT_c pinning centers due to their wavelength of typically 10-60 nm which is comparable to the ideal pinning-center size of 2 ξ (10 nm for $YBa_2Cu_3O_x$ in the ab-plane). Compared to similar structures in ternary $(Sm,Eu,Gd)Ba_2Cu_3O_x$ (SEG) and $(Nd,Eu,Gd)Ba_2Cu_3O_x$ (NEG)) systems, where the stripes appear either as plateau-like stripes or as chains of aligned clusters, the stripes in SmBCO always appear as plateau-like stripes with a height of 1 Å- 8Å. These pinning structures throughout the whole sample volume may be a key