TT 8.2 Mon 14:00 Poster A

TEM analysis of biaxially textured $La_2Zr_2O_7$ thin films by the Moiré technique — •Leopoldo Molina[1], Kerstin Knoth[2], Bernhard Holzapfel[2], and Oliver Eibl[1] — [1]Institute of Applied Physics, University of Tübingen, Auf der Morgenstelle 10, D-72076, Tübingen, Germany — [2]IFW Dresden, P.O.Box 270116, D-01171 Dresden, Germany

Chemically deposited $La_2Zr_2O_7$(LZO) buffer layers on biaxially textured nickel tungsten substrates for $YBa_2Cu_3O_{7-\delta}$(YBCO) coated conductor technology have been investigated by transmission electron microscopy (TEM). The biaxially textured LZO thin films were 80 nm thick and were annealed at T = 900°C. The samples were then prepared in plan-view for TEM investigations. The Ni grain size is about 40 μm, whereas the grain size of the LZO films is about 100 nm. The Moiré fringe contrast magnifies the misorientation of the LZO grains with respect to the underlying Ni grain by about a factor of 10. Imaging of small rotations ($\leq 3°$) of the LZO grains with respect to the underlying nickel tungsten grains was possible. Thus, the large misfit of 7.6 % between the LZO film and the nickel tungsten substrate might be additionally compensated by the tilting of the small LZO grains rather than by only introducing misfit dislocations at the substrate-film interface.

TT 8.3 Mon 14:00 Poster A

Ru moment in the magnetically ordered superconductor $RuSr_2GdCu_2O_8$ — •Thomas P. Papageorgiou[1], Eugenio Casini[2], Yuri Skourski[1], Thomas Herrmannsdörfer[1], Jens Freudenberger[3], Hans F. Braun[2], and Jochen Wosnitza[1] — [1]Hochfeld-Magnetlabor Dresden (HLD), Forschungszentrum Dresden-Rossendorf, D-01314 Dresden, Germany — [2]Physikalisches Institut, Universität Bayreuth, D-95440 Bayreuth, Germany — [3]IFW Dresden, Institute for Metallic Materials, D-01171 Dresden, Germany

Magnetization measurements of the superconducting ($T_c \approx 47$ K) and magnetically ordered ($T_M^{Ru} \approx 130$ K) $RuSr_2GdCu_2O_8$ (Ru1212) have been performed in pulsed magnetic fields up to 47 T. The average Ru-moment, determined by using $NbSr_2GdCu_2O_8$ as reference, is 1.8 μ_B suggesting that the investigated sample is in a mixed valence state containing 87% Ru^{5+} (2 μ_B) and 13% Ru^{4+} (0.9 μ_B). This ratio is consistent with an underdoped nature of the superconducting state with a hole concentration in the CuO_2 plane of p ≈ 0.065. It is suggested that the magnetic structure of Ru1212 consists of a main antiferromagnetic phase formed by Ru^{5+}ions interrupted by ferromagnetic stripes, where double exchange between Ru^{5+} and Ru^{4+} ions takes place. Different Ru^{5+}/Ru^{4+} ratios, due to different preparation conditions, could explain some of the diverse superconducting and magnetic properties reported in the literature for Ru1212.

TT 8.4 Mon 14:00 Poster A

High-Resolution Specific-Heat data of $YBa_2Cu_3O_x$ up to 400 K — •Christoph Meingast[1], Akira Inaba[2], Thomas Wolf[1], Volker Pankoke[1], Rolf Heid[1], and Klaus-Peter Bohnen[1] — [1]Forschungszentrum Karlsruhe, Institut für Festkörperphysik, D-76021 Karlsruhe, Germany — [2]Research Center for Molecular Thermodynamics, Graduate School of Science, Osaka University, Toyonaka, Osaka 560-0043, Japan

Very accurate (0.1 percent) adiabatic specific heat measurements up to 400 K have been made on $YBa_2Cu_3O_x$ samples with oxygen contents x = 6.7, 6.9 and 7.0. The oxygen deficient samples clearly show an anomaly due to the oxygen ordering above room temperature. In order to analyze this oxygen-ordering contribution, as well as the electronic contribution, in detail, the phonon contribution, obtained by first-principles electronic structure calculations, was subtracted from the data. This subtraction works quite well, which demonstrates the quality of both the measured and calculated heat capacities.

TT 8.5 Mon 14:00 Poster A

Anomalous magnetic field dependence of the superconducting condensation energy in $YBa_2Cu_3O_7$ single crystals — •P. Popovich[1,2], C. Meingast[1], S. Tajima[3], and T. Masui[3] — [1]Forschungszentrum Karlsruhe, Institute for Solid-State Physics, 76021 Karlsruhe, Germany — [2]Fakultät für Physik, Universität Karlsruhe, Germany — [3]ISTEC, Tokyo, Japan

The anisotropic magnetostriction and thermal expansion of untwinned $YBa_2Cu_3O_7$ single crystals have been studied using capacitance dilatometry for $H||c$ along all crystallographic axes. The thermodynamical analysis is possible due to the high crystal quality. The magnetostriction coefficient $\lambda_i = \frac{1}{L_i}\frac{dL_i}{dH}$ (i=a,b,c) is reversible above 55 K, providing important information about the pressure dependencies of the thermodynamical critical field $H_c(T)$.

The magnetic field dependence of the zero-temperature superconducting condensation energy is obtained by using the fact that the length (volume) difference between normal and superconducting states, L_n-L_s, provides a direct measure of the uniaxial pressure (hydrostatic pressure) dependence of the superconducting condensation energy. In conventional BCS superconductors, the superconducting condensation energy, as well as the magnitude of L_n-L_s, decreases monotonically with increasing field due to the increasing density of normal-state vortex cores. We find practically no field dependence of L_n-L_s as T approaches zero, which implies that the superconducting pairing energy is nearly field-independent in magnetic field up to 10 T.

TT 8.6 Mon 14:00 Poster A

Thermal Conductivity of underdoped $YBa_2Cu_3O_y$ — •Robert Schneider[1], Anja Waske[1], Christian Hess[1], Bernd Büchner[1], Vladimir Hinkov[2], and Chengtian Lin[2] — [1]Leibniz-Institute for Solid State and Materials Research, IFW-Dresden, 01171 Dresden, Germany — [2]Max Planck Institute for Solid State Research, Heisenbergstrae 1, D-70569 Stuttgart, Germany

We present experimental results on the thermal conductivity κ of an untwinned, underdoped $YBa_2Cu_3O_y$ monocrystal along the 'a direction' with a critical temperature of T_c = 61 K. We observe a peak at low temperatures as it has been previously found for the optimally doped material, for which it is known that the peak originates from heat transport by electronic quasiparticles. However, unlike for this latter case we do not observe a sharp onset of the peak at T_c but find a continuous increase already below $T \approx 150$ K. This increase becomes steeper at T_c and κ eventually peaks around 30 K. A magnetic field perpendicular to the CuO_2 planes significantly suppresses κ in the superconducting phase.

TT 8.7 Mon 14:00 Poster A

Surface studies of underdoped $YBa_2Cu_3O_{6.6}$ by means of Scanning Tunneling Microscopy — •Grzegorz Urbanik[1,2], Torben Hänke[1], Christian Hess[1], Bernd Büchner[1], Antoni Ciszewski[2], Vladimir Hinkov[3], and Chengtian Lin[3] — [1]Leibniz-Institute for Solid State and Materials Research, IFW-Dresden, 01171 Dresden, Germany — [2]Institute of Experimental Physics, University of Wroclaw, Poland — [3]Max Planck Institute for Solid State Research, Heisenbergstrae 1, D-70569 Stuttgart, Germany

According to the data in the literature, low temperature (< 40 K) cleaving of $YBa_2Cu_3O_{7-\delta}$-single crystals under UHV conditions (in order to get high quality surfaces), leads mainly to either BaO or CuO sheets as the topmost layer. We performed scanning tunneling microscopy and spectroscopy on high quality underdoped $YBa_2Cu_3O_{6.6}$ crystals. We present topographic results and a detailed statistical analysis of the step heights on a micrometer scale. Our data show that the cleaving of this material below 40K is much more complicated than anticipated. We find that the material primarily cleaves in multiples of one unit cell. Fractional step heights are also found, but only in few cases (∼ 5%). The topmost layers often exhibit a high corrugation (∼ 3 Å) which indicates that cleaving takes place at either the CuO chain layer or the Y-layer involving a non-uniform distribution of the layer atoms on the two cleaving planes. Furthermore, scanning tunneling spectroscopy reveals that terraces with a height difference smaller than one unit cell differ significantly in their tunneling conductance.

TT 8.8 Mon 14:00 Poster A

The bulge in the basal plane of cuprate superconductors - evidence for 3a singlet hole pair formation — •Jürgen Röhler — Universität zu Köln, 50937 Köln, Germany

In the cuprate superconductors the variaton of the basal lattice parameters upon doping is expected to follow the ubiquitous 1-log$m$ behavior of interatomic distances in systems with varying covalency – a behavior discovered by L. Pauling within his theory of resonant valence bonds. m is the degree of covalency. Detailed crystallographic work from the hole doped cuprates, however, finds the interatomic distances in the CuO_2 planes (plotted as a^2 or ab) concave away from the doping axis, not convex toward it. The resulting bulge in the basal plane area is maximum at optimum doping $n_{opt} \simeq 0.16$, and collapses within the weakly overdoped regime around $n \simeq 0.22$. We connect the bulge with a doping dependent repulsive interaction arising from the higher stability of the resonant (ZR) singlet hole states relative to that of single