Bayreuth, D-95440 Bayreuth

We have investigated the effect of a variation of the Ru content in $RuSr_2GdCu_2O_8$ (RuGd1212) on sample properties as for example shifts of the superconducting and magnetic transition temperatures T_c and T_m and the presence of phases in equilibrium with RuGd1212. The procedure of sample preparation can strongly affect the magnetic and superconducting properties of RuGd1212. Due to the relatively high volatility of the Ru-oxides at temperatures around 1000°C, a Ru loss can arise during calcination of the starting materials, the preparation of the Sr_2RuGdO_6 precursor and the final sintering process of RuGd1212.

The starting composition for our RuGd1212 was a mixture of CuO and Sr_2RuGdO_6 in the stoichiometric ratio 2:1. Samples were sintered in an O_2/Ru-oxide gas flow with variable Ru content. An increase of the Ru concentration in the gas mixture leads to a decrease of T_c and an increase of T_m. In sample areas exposed to the gas flow, additional phases coexisting with RuGd1212 were observed at higher Ru-oxide partial pressure. Thus, sintering of RuGd1212 in O_2/Ru-oxide gas flow with variable partial pressure of Ru-oxide controls the loss or increase of Ru in RuGd1212. The different Ru contents in RuGd1212 result in changes of T_c and T_m. This is compatible with the results of experiments where Ru is partially substituted by Cu.

TT 15.8 Tue 14:00 Poster B

Elektromechanische und thermische Charakterisierung von Bi-2223 Hochtemperaturbandsupraleitern bei kryogenen Temperaturen — •Philipp Keller[1,2], Michael Schwarz[1], Klaus-Peter Weiss[1], Reinhard Heller[1] und Sonja Schlachter[1] — [1]Institut für Technische Physik, Forschungszentrum Karlsruhe — [2]Kirchhoff-Institut, Universität Heidelberg

Um den Energiebedarf der Menschen auch in Zukunft befriedigen zu können, sind neue Wege in der Gewinnung, der Speicherung und dem Transport nutzbarer Energien erforderlich. Hierbei spielen Supraleiter und vor allem die im Jahre 1986 entdeckten Hochtemperatursupraleiter eine zunehmend wichtige Rolle. Um diese jedoch technisch nutzen zu können, müssen die Supraleiter in einer der Anwendung angepassten Form gefertigt und physikalisch charakterisiert werden. Am Beispiel von Bi-2223 Bändern für die Anwendung in supraleitenden Stromzuführungen wurden typische Größen wie der kritische Strom Ic unter äußerer mechanischer Spannung, sowie die thermischen Eigenschaften, speziell die thermische Leitfähigkeit und die Längenausdehnung, untersucht. Somit kann der Einfluss der Leiterparameter (z.B. supraleitendes Material, Matrixmaterial, Füllfaktor) bestimmt und die gewünschten Eigenschaften des Bandsupraleiters durch den gezielten Einsatz entsprechender Materialien optimiert werden, was letztendlich die technische Anwendung ermöglicht. Ein tiefer gehendes Verständnis wird durch eine FEM-Modellierung der elektrischen, thermischen und mechanischen Eigenschaften eines Bi-2223 Bandleiters und deren Vergleich mit den durchgeführten Messungen gebildet.

TT 15.9 Tue 14:00 Poster B

In-plane anisotropy of the spin excitation spectrum in strongly underdoped $YBa_2Cu_3O_{6+x}$ — •Daniel Haug[1], Vladimir Hinkov[1], Benoît Fauqué[2], Philippe Bourges[2], Yvan Sidis[2], Alexandre Ivanov[3], Chengtian Lin[1], and Bernhard Keimer[1] — [1]Max-Planck-Institut für Festkörperforschung, Stuttgart, Germany — [2]Laboratoire Léon Brillouin, CEA-CNRS Saclay, France — [3]Institut Laue-Langevin, Grenoble, France

The spin excitation spectrum of the optimally doped and moderately underdoped high-temperature superconductor $YBa_2Cu_3O_{6+x}$ is dominated by the so-called resonance peak for excitation energies between 30 and 40 meV (depending on the oxygen content x) that sets in abruptly below T_c. Here we report measurements on arrays of untwinned single crystals in the strongly underdoped regime in which the situation is very different: Spectral weight is shifted towards low energies and evolves smoothly through T_c. The spectrum exhibits a peak below ∼10 meV which shows a spontaneous onset of a strong anisotropy in the a-b-plane defined by the CuO_2 layers. This phenomenon matches the symmetry properties of a nematic liquid crystal, a new symmetry-broken electronic phase that coexists with high-temperature superconductivity in strongly underdoped cuprates.

TT 15.10 Tue 14:00 Poster B

Energy gap and asymmetry of coherence peaks in 123 cuprate superconductors and their T_c dependence — •Pintu Das[1,3], Michael R. Koblischka[1], Thomas Wolf[2], and Uwe Hartmann[1] — [1]Institute of Experimental Physics, University of Saarland, 66041, Saarbruecken, Germany — [2]Forschungzentrum Karlsruhe GmbH, Institute of Solid State Physics, 76021 Karlsruhe, Germany — [3]Max Planck Institute of Chemical Physics of Solids, Nöthnitzer Str. 40, 01187 Dresden, Germany

The energy gap in conventional superconductors is directly proportional to the transition temperature. In high-T_c cuprate superconductors, scanning tunneling spectroscopy (STS) and angle resolved photoemission studies have often shown that the underdoped samples which have low T_c values exhibit very large energy gaps giving rise to a high value of the coupling ratio ($2\Delta/k_BT_c$). This has been mostly observed for $Bi_2Sr_2CaCu_2O_{8+\delta}$. In this work, we observe from the STS experiments on $NdBa_2Cu_3O_{7-\delta}$ single crystal samples that the average energy gap increases with the decrease of T_c. For a moderately underdoped sample the coupling ratio is found to be as high as 18. We also observed an asymmetry in coherence peaks which is minimum in the case of optimally doped (highest T_c) samples. The observed T_c dependence of the asymmetry suggests that it is related to the number of electrons and holes.

TT 15.11 Tue 14:00 Poster B

STM based inelastic electron tunneling spectroscopy on $NdBa_2Cu_3O_{7-\delta}$ — •Pintu Das[1,2], Michael R. Koblischka[1], Helge Rosner[2], Thomas Wolf[3], and Uwe Hartmann[1] — [1]Institute of Experimental Physics, University of Saarland, 66041, Saarbruecken, Germany — [2]Max Planck Institute of Chemical Physics of Solids, Nöthnitzer Str. 40, 01187 Dresden, Germany — [3]Forschungzentrum Karlsruhe GmbH, Institute of Solid State Physics, 76021 Karlsruhe, Germany

Inelastic electron tunneling spectroscopy (IETS) is a very powerful tool to detect collective excitations in conducting materials. Due to inelastic excitation by tunneling electrons, a very weak kink is usually observed in dI/dV curves at the bias voltage corresponding to the excitation energy. In IETS on s wave superconductors, phonon modes (ω_{ph}) were observed at energies given by $E = \Delta + \hbar\omega_{ph}$, where Δ is the energy gap. Recently IETS using scanning tunneling spectroscopy (STS) has been used to detect a bosonic mode in $Bi_2Sr_2CaCu_2O_{8+\delta}$ [1]. In the STS data obtained on $NdBa_2Cu_3O_{7-\delta}$ single crystals, we observed peaks in d^2I/dV^2 curves beyond the coherence peaks from which collective excitation energies of ∼ 23 meV and ∼ 34 meV have been found for the samples with T_c of 93.5 K and 95.5 K respectively. Band structure calculation shows that there is no structure in the density of state at the observed energies which thus supports the presumption that the observed kinks in dI/dV curves are due to inelastic scattering of electrons.

[1] Lee et al., Nature **442**, 546 (2006).

TT 15.12 Tue 14:00 Poster B

Magic doping fractions in Bi2201 — •Lenart Dudy, Alica Krapf, Beate Müller, Olaf Lübben, Helmut Dwelk, Christoph Janowitz, and Recardo Manzke — Humboldt-Universität zu Berlin, Institut für Physik, Newtonstr.15, D-12489 Berlin, Germany

One interesting feature in the hole doped cuprates is the depression of the superconducting transition temperature at certain hole doping fractions. The 1/8 depression in $La_{2-x}Sr_xCuO_4$(LSCO) [1] is widely accepted, and can be interpreted in terms of static stripes [2] - but also by a structural tetragonal-orthorhombic (LTT-LTO) phase transition [3]. In our view the structural interpretation can be ruled out, as additional to 1/8 other fractional depressions were deduced for LSCO (i.e. at 1/16; 3/32; 1/8; 3/16) [4]. But these fractions may also violate the stripe picture, as they can not be interpreted by a static one-dimensional arrangement of holes in the CuO_2-plane but by a two-dimensional one. Despite one controversial report [5] in the Bismuth cuprates the knowledge of the existence or non existence of such fractions is very poor. We will show that also in the one-layer Bismuth cuprate the depressions at certain hole doping fractions exist which are equal to the fractions found by [4]. This may point to a generality of magic doping fractions in the cuprates.

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[2] D.L. Feng et al., Journ. of Phys. and Chem. of Solids 67, 198 (2006)
[3] J. Zhao et al., Supercond. Sci. Technol. 18, 966 (2005)
[4] S. Komiya et al., Phys. Rev. Lett. 94, 207004 (2005)
[5] W.L. Yang et al., Phys. Rev. B 62, 1361 (2000) 1

TT 15.13 Tue 14:00 Poster B

STM investigated characteristics of Pb-Bi2201 in dependence of the lead content — •Olaf Lübben, Lenart Dudy, Alica Krapf,