HIGH T_C UPDATE

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Coated Conductors

The deposition of large-area *$YBa_2Cu_3O_{7-\delta}$ (YBCO)* films by reactive thermal co-evaporation on biaxially textured *YSZ* (*Y_2O_2*-stabilized *ZrO_2* or yttria-stabilized zirconia) fabricated by ion-beam-assisted deposition (IBAD) is reported by M. Bauer (TU-München) et al. Polycrystalline, partially stabilized zirconia *(PSZ)* of area 10 cm $\times$ 10 cm was used as a substrate. Homogeneous, biaxially aligned IBAD buffer layers were prepared using large ion guns and substrate rotation during the IBAD process. *YBCO* films with thickness up to 1.4 μm were deposited. The biaxial alignments of the buffer layer and *YBCO* film were characterized by x-ray diffraction. The full width at half maximum (FWHM) of *YSZ* (111) φ-scans varied from 15° to 20°, while the FWHM of the *YBCO* (103) was always several degrees better, ranging from 7° to 9°. The *YSZ* thickness dependence of this improvement was investigated. The authors achieved a mean critical current density (at 77 K in self-field) of 1.9 MA/cm^2 and a maximum critical current density of 2.1 MA/cm^2 on a substrate area of 10 cm $\times$ 10 cm.

The deposition of high-quality *YBCO* films on metal (Hastelloy) tapes with biaxially aligned *MgO* buffer layers is reported by M. Bauer et al. (TU-München). The authors used e-gun evaporation on inclined substrates with a very high deposition rate, up to 250 nm/min, to deposit the buffer layers. The *MgO* layers were found to be biaxially textured with an in-plane FWHM of 8°. The *MgO* [001] direction was found not to be perpendicular to the substrate but instead tilted significantly toward the deposition direction. *YBCO* films were deposited on the ISD (inclined substrate deposition) buffer layers by reactive thermal co-evaporation. The critical current density of the films was found to be anisotropic because of the tilt of the [001] axis. Critical current densities up to 0.79 MA/cm^2 at 77 K in self-field were achieved.

A preprint by N. F. Heinig (Wisconsin and LBNL) et al. reports detailed transport and microstructural studies of transport links made from coated-conductor *YBCO* prototypes deposited on *YSZ* by pulsed-laser deposition (PLD). The first sample had the *YSZ* layer directly sputtered onto an Inconel-625 substrate by IBAD, and the second sample had a buffer layer of *CeO_2* between the *YSZ* and the Inconel. The textured *$YBa_2Cu_3O_{7-\delta}$* layer on the first sample had an in-plane mosaic spread of 12.4° FWHM, and that on the second sample had a spread of 9.0°. For transport links fabricated on the first sample, the self-field, 77 K critical current density was 0.7 MA/cm^2 for link A and 1.3 MA/cm^2 for link B. Magneto-optical and SEM studies showed the presence of many small defects, including submicron-sized voids, which evidently disrupted current flow in the link with the lower J_C.

Measurements of the magnetic-field-dependent critical current J_C(B,77K) of PLD *YBCO* films on symmetric [001] tilt bicrystals of *$SrTiO_3$* are reported by D. T. Verebelyi et al. (ORNL). The measurements in strong magnetic fields are consistent with the following picture: Low-angle grain boundaries (<10°) are composed of well-ordered bridges that act as strong superconducting intergranular links, while large-angle grain boundaries exhibit weak-coupling behavior but retain a well-defined critical current even at high field.

A comparative study of thin films of *$YBa_2Cu_3O_{7-\delta}$ (YBCO)* and *$NdBa_2Cu_3O_{7-\delta}$ (NBCO)* grown by PLD is reported by A. Eulenburg (Strathclyde) et al. For optimized transition temperatures, the authors found the deposition parameter settings of target-substrate distance, oxygen pressure, and laser energy density to differ significantly for *YBCO* and *NBCO*. While the maximum transition temperatures obtained were similar (~90 K) for the two materials, all *NBCO* films had a roughness comparable with the c-axis unit-cell dimension, while the *YBCO* films had a surface roughness that varied between 5 and 17 nm, depending on the growth conditions, indicating a difference in growth mode. The authors' atomic-force-microscope (AFM) and scanning-tunneling-microscope

(STM) studies suggest a 3D screw-dislocation-mediated growth for *YBCO* and a 2D layer-by-layer process for *NBCO*.

$RBa_2Cu_3O_{7-\delta}$

Measurements of the field and temperature dependence of the penetration depth λ in high-purity, untwinned single crystals of *$YBa_2Cu_3O_{6.95}$* in all three crystallographic directions have been carried out by A. Carrington (Illinois-Urbana and Leeds) et al. The authors found the temperature dependence of λ to be linear down to low temperatures, showing that their crystals were extremely clean. Both the magnitude and temperature dependence of the field-dependent correction to λ, however, were found to be considerably different from theoretical predictions of the nonlinear Meissner effect for a d-wave superconductor (Yip-Sauls theory). The results suggest that the Yip-Sauls effect is either absent or unobservably small in the Meissner state of *$YBa_2Cu_3O_{6.95}$*.

A preprint by J. M. Chen (SRRC-Hsinchu) et al. reports measurements of the *O* K-edge x-ray-absorption near-edge-structure (XANES) spectra of *$(Nd_{1-x}Pr_x)_{1.05}Ba_{1.95}Cu_3O_7$* for x = 0 - 0.5 and *$Nd_{1.05}(Ba_{1-z}Pr_z)_{1.95}Cu_3O_{7+\delta}$* for z = 0 - 0.25 in a search for microstructural features and hole distribution changes related to the superconducting properties. The authors found that the effect of *Pr* on the *Ba* site in *$Nd_{1.05}(Ba_{1-z}Pr_z)_{1.95}Cu_3O_{7+\delta}$* is to reduce the hole concentration in the *CuO_2* planes and to create localized five-fold *Cu* chain sites, such that the T_c of this material is depressed upon *Pr* doping primarily due to hole filling and hole localization. The authors also conclude that, in comparison with *$(Nd_{1-x}Pr_x)_{1.05}Ba_{1.95}Cu_3O_7$*, the enhanced suppression of T_c in *$Nd_{1.05}(Ba_{1-z}Pr_z)_{1.95}Cu_3O_{7+\delta}$* is primarily due to hole localization.

The magnetic response of a single-crystal *$YBa_2Cu_3O_{7-\delta}$* bulk specimen has been measured by S. Tochihara et al. (NDA-Yokosuka) in terms of complex susceptibilities. The authors analyzed the nonlinear magnetic response in terms of a modified Kim-Anderson critical-state model, where a surface barrier ΔH and the lower critical field H_{c1} also were taken into account. The best fit of the data gave $\mu_0\Delta H(0) \approx 80$ mT, and correcting for demagnetization gave an intrinsic value of the Bean-Livingston surface barrier of $\mu_0\Delta H'(0) \approx 440$ mT.

Detailed studies of pseudo-binary *$NdBa_2Cu_3O_X$*-*$Ba_3Cu_{10}O_{13}$* phase diagrams and the crystallization of *$NdBa_2Cu_3O_X$ (Nd-123),* using *in-situ* high-temperature optical-microscope observations under three different oxygen atmospheres (1%, 0.1%, and 0.0097% oxygen in argon), have been carried out by D. K. Aswal (RIE-Hamamatsu and BARC-Mumbai) et al. The results of these investigations should provide important guidelines for growing defect-free *Nd-123* crystals under reduced oxygen atmosphere.

Bi Cuprates

The momentum dependence of the superconducting gap at low temperatures has been precisely determined by J. Mesot (Argonne and Illinois-Chicago) et al. from angle-resolved-photoemission (ARPES) measurements on overdoped and underdoped samples of *$Bi_2Sr_2CaCu_2O_{8+\delta}$ (Bi-2212).* The authors found that as the doping decreases, the maximum gap increases, but the slope of the gap near the nodes decreases. Though consistent with d-wave symmetry, the gap with underdoping cannot be fit by the simple form, $\cos(k_x) - \cos(k_y)$. The authors suggest that this occurs because of the increasing importance of long-range interactions upon approaching the insulating state. The authors also note that their results have a direct bearing upon the low-temperature linear-in-T dependence of the penetration depth, and that a comparison with available data shows that a description in terms of noninteracting quasiparticles is inadequate.

Isothermal melt processing (IMP) has been used by T. G. Holesinger (Los Alamos) et al. to produce phase-pure, high critical current density *Bi-2212* tapes at temperatures as low as 780°C. *Bi-2212* tapes processed by IMP have yielded self-field J_c values up to 250 kA/cm^2 (I_c = 345 A) at liquid-helium temperatures. Small test coils have been produced with J_c values up to 150 kA/cm^2. The authors studied the effects of oxidation rate, processing temperature, and time spent in the partial melt upon the superconducting properties and microstructure. Optimal superconducting properties were found to result from the interplay of these parameters, such that the grain size of the *Bi-2212* phase in the polycrystalline core is allowed to coarsen and align itself with the silver sheath to form a well-connected superconductor.

Processing of *Bi-2223/Ag* tapes in a three-stage sintering process with reduced last processing temperature and intermediate cooling to room temperature has been found by B. Lehndorff (Wuppertal) et al. to lead to enhanced critical current densities. The authors found by x-ray diffraction that this is accompanied by the reduction of second phases such as *Bi-2201* and *Bi-3221 (*$Bi_{0.5}Pb_3Sr_{2.5}Ca_2CuO_X$*,* sometimes referred to as *3321* instead of *3221)* in the superconducting core. Electron microscopy has shown that these phases tend to precipitate between the *Bi-2223* grains, where they can hinder the current path. As a tentative explanation for the reduction of *Bi-3221,* the authors propose a complicated reaction between *Bi-3221,* alkaline earth cuprates, *Bi-2212,* and *Bi-2223*.

Other Cuprates

The properties of low-temperature-synthesized alkali-substituted phases $La_{2-x}K_xCuO_{4-\delta}$ with defined metal stoichiometry ($0 \le x \le 0.25$) are reported by W. Günther (TU-Berlin) et al. Electron diffraction shows a deviation from the ideal K_2NiF_4 structure. With regard to superconducting properties, an unusual result is that the nominal hole concentration for a given T_c value of the *K*-doped phases is twice the concentration required in alkaline-earth-doped systems.

The structure and magnetic properties of $La_4Cu_3MoO_{12}$, a new solid-state compound that forms at ambient pressure, are reported by D. A. Vander Griend (Northwestern) et al. The authors describe this as an $(ABO_3)_{n=4}$ cuprate with mixed *B*-cations in a ratio of one to three. When synthesized at ambient pressure, the structure is not perovskite as expected, but rather a homeotype of $YAlO_3$, a rare-earth hexagonal phase. The structure includes trigonal copper clusters with short *Cu-Cu* distances and geometric frustration, which strongly influence the magnetism, similar to the behavior in a kagome lattice. An antiferromagnetic transition occurs at 5 K, but the sample does not reach a purely paramagnetic state until the temperature exceeds 460 K.

Pressure Effects

A preprint by V. M. Svistunov (Donetsk) et al. reports tunneling measurements employing the Andreev reflection effect in N-S microjunctions to determine the anisotropy and pressure dependence of the energy gap in high-T_c superconductors. Results are reported for *(Bi,Pb)-2223* and *(Hg,Pb)-2223*. The authors found that $r = 2\Delta_{max}/k_BT_c$ increases with pressure: For *Bi-2223,* $dr/dP \approx 0.03$ kbar^{-1}, and for *Hg-2223,* $dr/dP \approx 0.06$ kbar^{-1}.

A neutron-diffraction study of *Hg-1201* has been carried out by A. M. Balagurov (JINR-Dubna) et al. to examine its structure under high pressure at low and high excess oxygen concentrations in the *Hg* layer (underdoped and overdoped states). The authors found that $HgBa_2CuO_{4+\delta}$ exhibits its highest T_c at an oxygen content in the *Hg* layer $\delta_{opt} = 0.13 \pm 0.01$, and that this oxygen is situated in the center of the *Hg* layer. The authors also found that at low O_δ concentrations the *Hg-1201* structure compresses isotropically; i.e., the compressibilities of the main interatomic distances correspond to the unit-cell compressibility.

The effect of hydrostatic pressure ($P < 0.6$ GPa) on the superconducting transition temperature T_c in $YBa_2Cu_3O_{7-\delta}$-$Pb(Sc_{0.5}Ta_{0.5})O_3$ *(YBCO-PST)* composites has been measured by M. Krupski (Poznan) et al. The authors found that the influence of pressure on T_c could be represented as $dT_c/dP = [0.61(2) - 1.72(6)\ x]$ K/GPa, where x is the *PST* fraction by weight.

Vortices

Two preprints by J. Lidmar and M. Wallin (Royal Institute of Technology) report Monte Carlo simulations of vortex lines in three-dimensional superconductors. One of these addresses questions of fluctuations, superconducting coherence, the helicity modulus, and vortex-lattice melting in *YBCO*. The other preprint reports a study of vortex lines in high-temperature superconductors with columnar defects produced by heavy-ion irradiation. The authors find the dynamic critical exponent describing the Bose-glass transition to be 4.6 ± 0.3. They also propose a scaling relation for tilted magnetic fields, which modifies the shape of the Bose-glass phase boundary.

The effect on vortex pinning of various configurations of columnar defects produced by heavy-ion irradiation in *YBCO* crystals has been studied experimentally by V. Hardy (Caen) et al. The authors studied (a) a standard configuration of tracks parallel to c, (b) a cross configuration consisting of tracks crossed at $\pm 5°$ relative to the c axis, and (c) a fan configuration consisting of crossed tracks at both $\pm 5°$ and $\pm 45°$, with the fraction of tracks with large angles being about 20%. For nearly all fields and temperatures, the persistent currents are substantially larger (i.e., vortex pinning is much more effective) for the cross and fan configurations than for the parallel configuration.

Energy dissipation from vortex motion in *YBCO* has been studied by R. Grosser et al. (Regensburg), who measured the damping of the oscillations of a small permanent magnet levitating between two parallel *YBCO* surfaces as a function of oscillation amplitude and temperature.

Analytical and numerical studies based on the time-dependent Ginzburg-Landau (TDGL) equations in two dimensions have been carried out by M. Ghinovker (Bar-Ilan) et al. to study the time evolution of the magnetic fields in a superconductor initiated by the introduction of a nonequilibrium, magnetic-flux-containing normal tube (supervortex). The authors find that possible scenarios are (a) a split of the supervortex, (b) regular growth of the Abrikosov lattice, and (c) an explosive creation of a vortex-antivortex liquid.

A preprint by S. V. Kuplevakhsky (Kharkov State and Bratislava) theoretically considers the problem of weakly coupled superconducting multilayers with tunnel barriers in the presence of an externally applied parallel magnetic field. The author's results strongly contradict a number of earlier theoretical results. For example, the author claims that (a) previous calculations of the lower critical field H_{c1} based on calculations of the properties of a single Josephson vortex parallel to the layers are unphysical, (b) the concept of a triangular Josephson vortex lattice is erroneous, and (c) magnetic flux first penetrates parallel to the layers simultaneously and coherently in the form of vortex planes.

Films

The submillimeter-wave $3\ cm^{-1} < \nu < 35\ cm^{-1}$ complex conductivity of a reduced $YBa_2Cu_3O_{6+\delta}$ film (T_c = 56.5 K) has been investigated by A. Pimenov (Augsburg) et al. for temperatures 4 K < T < 300 K and compared with the properties of the same film in the optimally doped state. The effective quasiparticle scattering rate $1/\tau^*(\nu)$ was found to be frequency-independent at low frequencies and high temperatures. A gradual change to a $1/\tau^* \propto \nu^{1.5}$ law was observed with decreasing temperature. The authors explain the observed temperature dependence of the low-frequency spectral weight in terms of a temperature-dependent quasiparticle effective mass for $T > T_c$.

Applications

A noninvasive method for the investigation of semiconductor wafers with high spatial resolution utilizing a superconducting quantum interference device (SQUID) magnetometer system is described in a preprint by J. Beyer et al. (PTB-Berlin). The method is based on the detection of the magnetic field caused by photocurrents generated in the semiconductor sample when laser light with a photon energy exceeding the bandgap of the semiconductor is focused onto the sample surface in a region of a doping gradient. The spatial resolution of this detection method is mainly determined by the size of the excitation focus of about 20 μm. The experiments reported here made use of two orthogonally arranged low-T_c SQUID magnetometers. The sample was mounted on an x-y stage, which could be moved relative to the fixed excitation spot and SQUID magnetometers for sample scanning.

Two preprints by B. A. Willemsen (Superconductor Technologies Inc.) et al. present experimental results on microwave intermodulation in high-T_c superconducting microwave resonators. Third-order microwave intermodulation results from nonlinear response of the superconductor. The papers present new results and introduce phenomenological theories to describe the observed response.

Theory

A microscopic theory of the electron spectrum and superconductivity in the limit of strong electron correlations has been formulated by N. M. Plakida and V. S. Oudovenko (JINR-Dubna). The authors consider the two-dimensional t-J model in a paramagnetic state by employing a projection technique for the Green functions in terms of the Hubbard operators. The authors perform a self-consistent numerical solution of the Eliashberg equations in the noncrossing approximation. They describe exchange and kinematical interactions with electrons with spin fluctuations via a dynamical spin susceptibility with short-range antiferromagnetic correlations. The resulting one-electron spectral density has narrow quasiparticle peaks close to the Fermi surface, with an additional broad incoherent band below the Fermi level. The quasiparticle dispersion, being small at low doping, $\delta < 0.1$, becomes large for moderate doping. The form of the Fermi surface changes from four hole pockets at $(\pm\pi,\pm\pi)$ points at low doping to a large electron-like surface crossing the $(\pm\pi,0)$, $(0,\pm\pi)$ points of the Brillouin zone at $\delta \approx 0.3$. The occupation numbers N(**k**) are large throughout the Brillouin zone and show only a small drop, increasing with doping, at the Fermi surface. The authors calculated the **k**- and ω-dependent superconducting gap function and T_c by a direct numerical solution of the linearized Eliashberg equations. The authors found d-wave symmetry of the gap and $T_c \approx 0.04$ t (50-200 K).

$LaCuO_{2.5}$ is a system of coupled, two-chain, cuprate ladders, which may be doped systematically by *Sr* substitution. Motivated by the recent synthesis of single crystals, B. Normand (Basel) et al. have theoretically investigated the possibility of superconductivity in this compound. The authors use a model of spin-fluctuation-mediated superconductivity, where the pairing potential is strongly peaked at π in the ladder direction. The authors solve the coupled gap equations on the bonding and antibonding ladder bands to find superconducting solutions across the range of doping, and they discuss the relevance of these solutions to the real material.

Results of calculations of the in-plane far-infrared conductivity of optimally doped $YBa_2Cu_3O_{7-\delta}$ in the normal and superconducting states are presented by D. Munzar et al. (MPI-Stuttgart). The computations include inelastic scattering of planar quasiparticles by spin fluctuations, which are described by the spin susceptibility in the form of the magnetic peak observed by neutron scattering. The superconducting gap was assumed to have $d_{x^2-y^2}$ symmetry. Both the real and imaginary parts of the self-energy were evaluated and used in computing the conductivity. The authors note that the trends observed in experiment are well reproduced, and that the theory provides a simple interpretation of the mid-infrared absorption in the normal and superconducting states.

In the presence of an external magnetic field, the low-lying elementary excitations of a d-wave superconductor have quantized energy, and their moments are locked near the node direction. B. Jankó (Argonne) argues that these discrete states should be detectable by a local probe, such as a scanning tunneling microscope. The author predicts a number of features that should be revealed by such an experiment.

The effect of spin injection into s- and d-wave superconductors, with an emphasis on the interplay between boundary

and bulk spin transport properties, has been studied by R. L. Merrill and Q. Si (Rice). The quantities of interest include the amount of nonequilibrium magnetization, the induced spin-dependent current, and the boundary voltage. Andreev reflections cause each of these three quantities to depend on a different combination of boundary and bulk contributions. The authors discuss the implications for on-going spin-injection experiments in high-T_c cuprates.

Other Activities

The intensity increase of a number of Raman-active phonons below the superconducting transition temperature in *$YBa_2Cu_3O_{7-\delta}$ (Y-123), $Bi_2Sr_2CaCu_2O_{8+\delta}$ (Bi-2212),* and *$Tl_2Ba_2CuO_{6+\delta}$ (Tl-2201)* crystals is discussed in a preprint by O. V. Misochko (Kansai Advanced Research Center and ISSP-Chernogolovka) et al. The authors show that the effect depends on polarization, doping, and resonance conditions, and they briefly discuss the different scattering mechanisms that could be responsible for this effect.

A preprint by A. Mourachkine (Brussels) states that the occurrence of spinon superconductivity and superconductivity with magnetic pairing due to spin waves in hole-doped *Bi-2212* raises questions about the origin of superconductivity in other cuprates, especially in the electron-doped *$Nd_{2-x}Ce_xCuO_4$ (NCCO)* cuprate.

Overviews

A review by P. Singha Deo et al. (Antwerp) reports numerical studies using the Ginzburg-Landau equations to examine the magnetic behavior of type-I (such as bulk *Al*) superconducting disks of finite radius R and thickness d in a perpendicular magnetic field. Depending on R and d, first- or second-order phase transitions between the normal and superconducting states occur, and for sufficiently large R, several transitions in the superconducting phase are found, corresponding to giant vortex states with different angular momentum (22 refs.).

Contributed by John R. Clem

Contents:

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M. Ghinovker, I. Shapiro, and B. Ya. Shapiro, "Explosive Nucleation of Superconductivity in Magnetic Field." To be published in Phys. Rev. B. Contact B. Ya. Shapiro, Institute of Superconductivity, Department of Physics, Bar-Ilan University, Ramat Gan 52900, ISRAEL. 74.20.De; 74.60.Ge.

R. Grosser, P. Höcherl, A. Martin, M. Niemetz, and W. Schoepe, "Vortex Motion in Superconducting $YBa_2Cu_3O_{7-\delta}$ Inferred from the Damping of the Oscillations of a Levitating Magnetic Microsphere." Institut für Experimentelle und Angewandte Physik, Universität Regensburg, D-93040 Regensburg, GERMANY; M. Niemetz's e-mail

michael.niemetz@physik.uni-regensburg.de; preprint also available at cond-mat@xxx.lanl.gov (#9901085). 74.60.Ge; 74.76.Bz; 74.80.Bj.

W. Günther, W. Paulus, and R. Schöllhorn, "Correlation Between Synthesis, Stoichiometry, Structure and Superconductivity of $La_{2-x}K_xCuO_{4-\delta}$." To be published in Physica C (in press). Institut für Anorganische und Analytische Chemie, Technische Universität Berlin, Strasse des 17. Juni 135, D-10623 Berlin, GERMANY; telephone +49 30 3142 6374; telefax +49 30 3142 1106; e-mail wulfg@fks.chem.tu-berlin.de. Key words: lanthanum copper oxide, crystal structure, superconductivity, alkali-doped cuprate.

S. A. Halim, S. B. Mohamed, H. Azhan, S. A. Khawaldeh, and H.A.A. Sidek, "Effect of Barium Doping in *Bi-Pb-Sr-Ca-Cu-O* Ceramic Superconductors." To be published in Physica C (in press). Superconductor and Thin Film Laboratory, Department of Physics, University Putra Malaysia, 43400 Serdang, Selangor D.E., MALAYSIA; telephone +60 3 948 6101, ext. 3552; telefax +60 3 943 2508; e-mail ahalim@fsas.upm.edu.my. Key words: ceramics superconductors, barium, temperature dependence.

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N. F. Heinig, G. A. Daniels, M. Feldmann, A. Polyanskii, D. C. Larbalestier, P. Arendt, and S. Foltyn, "Implications of Low Angle $YBa_2Cu_3O_{7-x}$ Bicrystal Transport Characteristics for Coated Conductor Applications." To be published in IEEE Trans. Appl. Supercond.: Proc. of the 1998 Appl. Supercond. Conf. (ASC), Palm Desert, Calif., Sept. 13-18, 1998. Lawrence Berkeley National Laboratory, 1 Cyclotron Road, MS 46-161, University of California, Berkeley, CA 94720; telephone (510) 486-6764; telefax (510) 486-5310; e-mail nfheinig@lbl.gov.

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mercury-based superconductors, *Hg-1223* phase, ^{57}Fe Mössbauer spectroscopy, ^{119}Sn Mössbauer spectroscopy.

Beate Lehndorff, Peter Hardenbicker, Michael Hortig, and Helmut Piel, "Evidence for Enhanced Grain Connectivity Due to Second Phase Reduction of *Bi-2223/Ag* Tapes." To be published in Physica C (in press). Bergische Universität FB08, Institut für Materialwissenschaften, Gausstrasse 20, D-42097 Wuppertal, GERMANY; phone +49 202 439 2860; fax +49 202 439 2811; e-mail lehnb@uni-wuppertal.de. Key words: *Bi-2223,* superconducting tapes, microstructure, critical current. 74.60.-w; 74.72.-h; 74.72.Hs; 81.40.Gh.

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Jack Lidmar and Mats Wallin, "Critical Properties of Bose-Glass Superconductors." Department of Theoretical Physics, Royal Institute of Technology, SE-100 44 Stockholm, SWEDEN; e-mail jack@theophys.kth.se; preprint also available at cond-mat@xxx.lanl.gov (#9812342). 74.60.Ge; 75.40.Mg; 05.70.Fh.

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J. Mesot, M. R. Norman, H. Ding, M. Randeria, J. C. Campuzano, A. Paramekanti, H. M. Fretwell, A. Kaminski, T. Takeuchi, T. Yokoya, T. Sato, T. Takahashi, T. Mochiku, and K. Kadowaki, "Changes in Superconducting Gap Anisotropy with Doping and Implications for the Penetration Depth." Materials Science Division, Argonne National Laboratory, 9700 South Cass Avenue, Argonne, IL 60439; M. R. Norman's e-mail norman@hexi.msd.anl.gov; preprint also available at cond-mat@xxx.lanl.gov (#9812377). 71.25.Hc; 74.25.Jb; 74.72.Hs; 79.60.Bm.

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D. Munzar, C. Bernhard, and M. Cardona, "Does the Peak in the Magnetic Susceptibility Determine the In-Plane Infrared Conductivity of *YBCO?* A Theoretical Study." To be published in Physica C (in press). Max-Planck-Institut für Festkörperforschung, Heisenbergstrasse 1, D-70569 Stuttgart, GERMANY; telephone +49 711 689 1744; telefax +49 711 689 1712; e-mail munzar@cardix.mpi-stuttgart.mpg.de. Key words: far-infrared spectra, d-wave superconductor, spin fluctuations.

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N. M. Plakida and V. S. Oudovenko, "Electron Spectrum and Superconductivity in the t-J Model at Moderate Doping." Preprint #E17-98-244; submitted to Phys. Rev. B. Joint Institute for Nuclear Research, 141980 Dubna, Moscow Region, RUSSIA.

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Y. Sun, J. D. Guo, X. L. Xu, G. J. Lian, Y. Z. Wang, and G. C. Xiong, "Superconducting $HgBa_2CaCu_2O_Y$ Thin Films Growth on $NdGaO_3$, $SrTiO_3$, $LaAlO_3$ and $Y\text{-}ZrO_2$ Substrates." To be published in Physica C (in press). Department of Physics, Peking University, Beijing 100871, PEOPLE'S REPUBLIC OF CHINA; telephone +86 1 256 4095. Key words: $HgBa_2CaCu_2O_y$, thin films, $NdGaO_3$, superconductivity.

V. M. Svistunov, A. I. D'yachenko, V. Yu. Tarenkov, and R. Aoki, "Andreev Reflection Spectroscopy of High-T_c Superconductors at High Pressures." To be published in Physica C (in press). Contact R. Aoki, College of Industrial Technology, 1-27 Nishi-Koya, Amagasaki 661, JAPAN. Key words: superconductivity, Andreev spectroscopy, energy gap, anisotropy. 74.50.+r; 74.76.Bz.

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D. T. Verebelyi, C. Prouteau, R. Feenstra, and D. K. Christen, "Critical Current of *YBCO* Grain Boundaries in Large Magnetic Fields." To be published in IEEE Trans. Appl. Supercond. Bldg. 3115, MS-6061, Oak Ridge National Lab., P.O. Box 2008, Oak Ridge, TN 37831-6061; phone (423) 574-6264; fax (423) 574-6263; e-mail vod@ornl.gov.

Balam A. Willemsen, K. E. Kihlstrom, and T. Dahm, "Unusual Power Dependence of Two-Tone Intermodulation in High-T_c Superconducting Microwave Resonators." To be published in Appl. Phys. Lett. Superconductor Technologies, Inc., 460 Ward Dr., Suite F, Santa Barbara, CA 93111-2310; telephone (805) 683-7646; telefax (805) 967-0342; e-mail balamw@suptech.com. Key words: nonlinear electrodynamics, microwave intermodulation, thin-film devices, *TBCCO* films. 84.40.Dc; 85.25.-j.

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COMING EVENTS

*(An * indicates a previously listed event.)*

***April 8 - 9, 1999:** Workshop on ac Losses (WACL 99), EPRI, Palo Alto, Calif. Two-day workshop will cover theoretical and experimental research on power-line-frequency (50-60 Hz) ac losses in high-temperature superconductors, and the influence such losses have on the design of HTS devices for electric power applications. No registration fee, but attendance limited to 65 participants. Applications by e-mail, consisting of name, institution, address, phone and fax numbers, e-mail address, and an abstract, will be used to select participants to present oral and poster papers. **Application deadline, Feb. 1, 1999.** Send duplicate applications to both Conference Co-Chairs: John R. Clem, e-mail clem@ameslab.gov; and Masaki Suenaga, e-mail mas@sun2.bnl.gov.

June 13 - 18, 1999: The Fifth IUMRS International Conference on Advanced Materials (IUMRS-ICAM'99): Symposium B – High T_c Superconductors, Beijing, China. Will provide a forum for exchange and discussion of new ideas and achievements related to high-T_c superconductors and their applications. Scope and topics include: Processing – bulk materials, tapes, strands, coated conductors and their substrates, and films; Properties (Measurement and Theory) – critical current, mechanical properties and strengthening in tapes and cables, and ac loss; Applications – motors and generators, current leads, fault current limiter, power cables, and electronics. **Abstract deadline, March 1, 1999; preregistration deadline, March 31, 1999.** Accepted papers will be published in Physica C or Cryogenics. For information, contact Yong Feng, Northwest Institute for Nonferrous Metal Research, P.O. Box 51, Xi'an, Shaanxi 710016, People's Republic of China; telephone +86 29 6231079; telefax +86 29 6231103; e-mail smrc@pub.xaonline.com.

July 1 - July 10, 1999: Nonlinearity, Integrability and All That – Twenty Years After NEEDS '79, Hotel Le Sirenuse, Gallipoli, Lecce, Italy. Purpose of the Workshop is to bring together qualified scientists working in nonlinear science and discuss recent developments, achievements in the last twenty years, and future perspectives. Specific topics will cover inverse scattering, hamiltonian structures, geometrical aspects, symmetries and applications of the theory to nonlinear optics, molecular dynamics, plasma waves, hydrodynamics, quantum electronics, solid-state physics, string theory, and gravity. The list is to be considered open, in view of possible new mathematical methods and applications. **Application deadline, March 31, 1999.** The Workshop will be also the occasion to celebrate twenty years of active engagement of the University of Lecce in developing international scientific cooperation in nonlinear science. An all-inclusive fee of Italian Lire 1,420,000 will cover the cost of registration, meals, and lodging during the Workshop and the transportation from nearby airports. Persons interested in participating can receive the second announcement with additional details and the registration form by contacting Maria Concetta Gerardi, Workshop Secretary, Dipartimento di Fisica, Università di Lecce, 73100 Lecce, Italy; telephone and telefax +39 832 320467; second telefax +39 832 320505; e-mail gerardi@le.infn.it; Web site www. fisica.unile.it/nonlinearity/.

Aug. 4 - 11, 1999:* 22nd International Conference on Low Temperature Physics (LT22), Helsinki University of Technology (HUT), Otaniemi, Espoo and Helsinki, Finland. Topics will include: quantum gases, fluids and solids; superconductivity; magnetism and lattice properties; quantum electron transport; applications; materials; and techniques. LT22 will have limited funds to assist graduate students, junior faculty, as well as participants from institutions and countries where support is difficult to obtain. **Deadline for support applications, February 15, 1999; preregistration and abstract deadline, April 15, 1999. Proceedings will appear as a special issue of Physica B – Condensed Matter, in April 2000. For information, contact Conference Service Bureau, TSG-Congress Ltd., Kaisaniemenkatu 3 B 31, FIN-00100 Helsinki, Finland; telephone +358 9 628044; telefax +358 9 667675; e-mail info@tsgcongress.fi. For technical information, contact the LT22 Office, Low Temperature Laboratory, Helsinki University of Technology, P.O. Box 2200, FIN-02015 HUT, Finland; telephone +358 9 451 2962; telefax +358 9 451 2969; e-mail info@LT22.hut.fi; Web site http://lt22.hut.fi/LT22/LT22.html.

Aug. 12 - 15, 1999: International Symposium on Ultralow Temperature Physics (ULT99), PTI Educational Centre, St. Petersburg, Russia. Satellite to the 22nd International Conference on Low Temperature Physics (LT22). Will provide a forum for the presentation and discussion of the results of recent scientific investigation in ultralow temperature physics. The main topics are: quantum liquids and solids, solids at ultralow temperatures, Bose-Einstein condensation, and ultralow-temperature techniques and thermometry. Limited financial support (mainly for students) is available. **Abstract deadline, March 15, 1999.** Contact Mikhail P. Volkov, Symposium Secretary, Ioffe Physico-Technical Institute, 26 Polytechnicheskaya, 194021 St. Petersburg, Russia, phone +7 812 515 9229; fax +7 812 515 6747; e-mail M.Volkov@shuvpop.ioffe.rssi.ru; Web site http://www.ioffe.rssi.ru/ULT99/. Or contact Vladimir V. Dmitriev, Program Committee Chairman; phone +7 095 137 6174; fax +7 095 938 2030; e-mail dmitriev@kapitza.ras.ru.

†*Sept. 27 - 30, 1999:* First Regional Conference on Magnetic and Superconducting Materials (MSM-99), Sharif University of Technology, Tehran, Iran. Conference intends to address the recent developments and improvements in the science and engineering of superconductivity and magnetism and their applications. Themes are designed to attract researchers and educators to share their recent findings and techniques in these fields. The main focus of the conference will be physics, materials science, and applications of magnetic and superconducting materials. Topics will include production, synthesis, and physical chemistry; microstructure; physical properties; flux dynamics; special magnetism; mathematical modeling; and applications. **Abstract deadline, February 28, 1999.** Graduate students and young researchers under 40 are encouraged to participate in the Young Researcher Award Competition. For information, contact The Secretariat, Magnet Research Laboratory, Department of Physics, Sharif University of Technology, P.O. Box 11365-9161, Tehran, Iran; telephone and telefax +98 21 6019246; e-mail msm-99@sina.sharifac.ir; Web Sites http://web.mit.edu/physics/msm99/ or http://www.sharif.ac.ir/~msm-99. †**(Note extended abstract deadline.)**

RESOURCES

Information

New Book: *High-Temperature Superconductors: Materials, Properties, and Applications,* by Rainer Wesche. Presents an overview of the known high-T_C superconductors and their physical properties and emphasizes aspects related to conductor fabrication and high-current applications. Provides an introduction to high-T_C superconductivity based on the fundamental physical principles of normal-state electrical conductivity and the well-known characteristics of conventional superconductors. Book describes crystal structures, anisotropic properties, and general trends of the critical temperatures of the cuprate superconductors, and addresses processing of superconductor powders, several fabrication techniques for superconducting wires, and factors limiting the transport critical currents of high-T_C wires. Also includes discussion of requirements for safe and stable operation of high-current superconductors and ac loss behavior of high-T_C superconductors. Presents an overview of potential magnet and power applications of high-T_C superconductors. Suitable for use in graduate-level courses on superconductivity. Contains a large number of tables and references. Publ. 1998; 456 pp.; price $150; ISBN 0-7923-8386-9. Contact Kluwer Academic Publishers, Order Department, P.O. Box 358, Accord Station, Hingham, MA 02018-0358; telephone (781) 871-6600; telefax (781) 871-6528; e-mail kluwer@wkap.com. Outside the U.S., contact Kluwer Academic Publishers, Book Department, P.O. Box 322, 3300 AH Dordrecht, The Netherlands; telephone +31 78 639 23 92; telefax +31 78 654 64 74; e-mail services@wkap.nl.

New Book: *Handbook of Cryogenic Engineering,* edited by John G. Weisend, II. Handbook offers up-to-date overview of the principal topics in cryogenics. Brings together results from recent surveys of the various cryogenic subfields, as well as specific details of equations and data points. Numerous tables, graphs, and equations. Readership: researchers, engineers, and students involved in cryogenics. Topics include properties of cryogenic fluids, properties of cryogenic materials, cryogenic heat transfer, cryogenic instrumentation, cryostat design, refrigerants for normal refrigeration, small cryocoolers, superconducting magnet technology, cryogenic equipment, *He-II,* and safety. Publ. 1998; 600 pp.; price $125; ISBN 1-56032-332-9. Contact Taylor and Francis, 47 Runway Road, Levittown, PA 19057; telephone (800) 821-8312; telefax (215) 269-0363; e-mail bkorders@taylorandfrancis.com.

Proceedings: *Current Problems in Condensed Matter – Proceedings of an International Workshop on Current Problems in Condensed Matter, Theory and Experiment,* Cocoyoc, Mexico, January 5-9, 1997, edited by J. L. Moran-Lopez. Thirty-four state-of-the-art reviews consider many of the most crucial problems under study in condensed matter. Topics include: physics of highly correlated electron systems (high-temperature superconductors, magnetism, and superconductivity), physical properties of low-dimensional systems, molecular dynamics of metallic and semiconductor clusters, electronic properties of fullerenes, surface properties of alloys and their capability to chemisorb atoms, spin density waves, Kondo insulators, and calculation of the bulk properties of alloys and nonperiodic systems. Publ. 1998; 370 pp.; price $125; ISBN 0-306-45915-9. Contact Plenum Publishing Corporation, Dept. TNC, 233 Spring Street, New York, NY 10013-1578; telephone (800) 221-9369 or (212) 620-8035, -8047, or -8052; telefax (212) 647-1898; e-mail info@plenum.com; Web site http://www.plenum.com.

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Position Open: Nordic Superconductor Technologies has a permanent position available in their Quality Group. First two years will be at the postdoctoral level, working in a research project between NST and Risø. Will involve the study of *Bi-2223* PIT tapes by magnetic characterization techniques (magneto-optics, ac susceptibility, scanning hall magnetometry) for more understanding of critical-current-limiting mechanisms. Subsequently, the project will involve development activities with engineers at NST to improve the current-carrying capability both in self-fields and applied magnetic fields. The candidate should have a less than three-year-old Ph.D. with experience in electrical and magnetic characterization of superconductors. For additional information, contact Per Vase, Vice President – Engineering, Nordic Superconductor Technologies A/S, Priorparken 878, 2605 Brøndby, Denmark; telephone +45 434 83592; telefax +45 433 82501; e-mail p.vase@nst.com; Web site http://www.nst.com.

Positions Open: The ISEM has two Research Fellow positions available at its facilities in Wollongong, Australia. First position involves work on coated conductors and requires the candidate to have extensive experience and skill in thin-film deposition using laser-ablation and other techniques. Second position involves study of flux properties and requires the candidate to have a strong background and research record in solid-state physics. Appointment will initially be on a two-year contract with the potential for extension. Applications should be forwarded to B. Allen, Administration Officer, Institute for Superconducting & Electronic Materials, University of Wollongong, Northfields Avenue, Wollongong, NSW Australia 2522; telefax +61 2 4221 5731; e-mail babs_allen@uow.edu.au.

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