HIGH T_C UPDATE

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Dear Readers:

You are now reading the final issue of *High-T_C Update,* which completes thirteen full years of publication. Here are some daunting statistics: 312 issues have been published, 4,992 pages printed, and 24,336 preprints listed! It has been a great ride for us, with many exciting discoveries along the way and significant strides towards commercialization. We like to think that *High-T_C Update* has played a significant role in expediting the pace of global superconductivity research. We appreciate all your wonderful letters, preprints, and financial contributions, but we especially thank you for sharing the excitement of your research with us.

Although the newsletter will no longer exist in its present form, we plan to keep our Web site updated with all the latest preprints, conference news, new job opportunities, new books and proceedings, and more. If you can help us with this effort in any way, please let us know. We will soon put our database (currently containing more than 65,500 papers!) on our Web site, in fully searchable form, culminating in what we hope will be a valuable literature search tool. Please continue to send us news of your preprints to include in this database. We will no longer require the complete papers in hard copy form; an e-mail notification and short abstract will suffice (please e-mail such notifications to htcc@ameslab.gov).

From all the staff members here at *High-Tc Update,* thank you and goodbye!

Sincerely yours,
Sreeparna Mitra, Project Director/Editor
John R. Clem, Science Editor

Films

One of the important characteristics of *$YBa_2Cu_3O_{7-\delta}$ (YBCO)* is that the intergranular critical current density J_c drops sharply as a function of the grain-boundary misorientation angle. As noted in a preprint by G. Hammerl et al. (Augsburg), interface charging at the grain boundary and the associated bending of the electronic band structure have an important influence on J_c. The Augsburg group previously has shown that it is possible to greatly increase J_c, but only at low temperatures, by using appropriate doping to reduce band bending. The present preprint describes the application of new techniques that result in the achievement of large enhancements of the grain-boundary critical current density at liquid-nitrogen temperature. In order to selectively overdope 24° [001] tilt grain boundaries over a few nanometers by taking advantage of *Ca* grain-boundary diffusion, the authors fabricated high-T_c doping heterostructures consisting of alternating layers of *$YBa_2Cu_3O_{7-\delta}$* and *$Y_{0.7}Ca_{0.3}Ba_2Cu_3O_{7-\delta}$*. In a trilayer sample, the net (self-field) critical current density was $J_c(77\ K) \approx 4.3 \times 10^5$ A/cm^2, a value equaling that reported for 24° grain boundaries in *$YBa_2Cu_3O_{7-\delta}$* films at 4.2 K and an order of magnitude larger than the 77 K values found in the literature. The authors suggest that large critical current densities should also be achievable using bulk techniques that preferentially overdope the grain boundaries. They also suggest that the use of doping heterostructures may help to further enhance J_c values at 77 K in coated conductors, such as those prepared using ion-beam-assisted deposition (IBAD) or rolling-assisted biaxially textured substrates (RABiTS).

The characteristics of the magnetic flux noise in superconducting thin films of $YBa_2Cu_3O_{7-\delta}$ in the vicinity of artificial grain boundaries have been studied by K. R. Bukh (Technical University of Denmark) et al. using a low-T_c SQUID magnetometer. While the measured power spectra typically showed 1/f behavior at low frequencies, some of the samples exhibited additional Lorentzian spectra, indicating flux hopping in the grain boundaries. The fluctuators were seen in the 60-80 K interval, corresponding to barrier heights of order 0.1-0.4 eV.

As reported by V. Selvamanickam (IGC) et al., a metal organic chemical vapor deposition (MOCVD) method has been developed to achieve high critical currents in *YBCO* superconducting films deposited on biaxially textured IBAD buffer layers of yttria-stabilized zirconia *(YSZ)* on polycrystalline (untextured) flexible metal substrates. Optimization of the MOCVD process parameters yielded critical currents I_c greater than 50 A (for *YBCO* width 3.5 mm and thickness 1 μm) and critical current densities J_c greater than 1×10^6 A/cm^2 at 77 K under self-field conditions. High values of J_c also were found to be maintained in the presence of a magnetic field.

Precise measurements of the microwave surface resistance $R_S(T)$ of a c-axis-oriented (but randomly in-plane-oriented) $YBa_2Cu_3O_{7-\delta}$ film fabricated on a 35 mm diameter copper disk with *YSZ* and chromium buffer layers are reported by J.-F. Liu (KEK) et al. The temperature dependence of $R_S(T)$ and the penetration depth $\lambda(T)$ could be fit by a modified two-fluid model, with the fraction of normal carriers varying as $(T/T_c)^2$ rather than $(T/T_c)^4$ and 20% of the charge carriers remaining normal.

Josephson junctions have been photogenerated by R. S. Decca (Maryland and IUPUI) et al. in underdoped thin films of the $YBa_2Cu_3O_{6+x}$ family using a near-field scanning optical microscope. The observation of the Josephson effect for separations as large as 100 nm between two wires indicates the existence of an anomalously large proximity effect and shows that the underdoped insulating material in the gap of the junction is readily perturbed into the superconducting state. The result constrains the applicability of SO(5) theory to explain the phase diagram of high-T_c superconductors.

A preprint by H. Sato (NTT) et al. reports that (001)-oriented thin films of $La_{2-x}Sr_xCuO_y$ with *Sr* composition x = 0 to 2 have been grown by reactive coevaporation. The c-axis length, observed by x-ray diffraction, changed systematically, indicating that single-phase films were obtained for the entire composition range. Films with oxygen composition y ~ 4 showed superconductivity for $0.06 < x < 0.30$. For x = 0.15, T_c was maximized at 44 K, due to a strain effect caused by the lattice mismatch between the films and substrates.

$RBa_2Cu_3O_{7-\delta}$

Several papers by M. Muralidhar et al. (SRL-ISTEC) report various studies of melt-processed superconductors *(Nd,Eu,Gd)*$Ba_2Cu_3O_{7-\delta}$ *(NEG-123)* and *(Nd,Sm,Eu,Gd)*-$Ba_2Cu_3O_{7-\delta}$ *(NSEG-123).* The authors find that *NEG-123* bulk superconductors have the highest values of J_c, surpassing those in *Y-123, Nd-123,* and *NSEG-123* at all fields and temperatures.

Two preprints by C.-J. Kim (KAERI) et al. report studies of top-seeded melt growth of *Y-123* superconductors using two or more seeds of composition $Sm_{1.8}Ba_{2.4}Cu_{3.4}O_{7-\delta}$. The authors studied the effect of the separation of the seeds upon levitation forces and trapped magnetic fields.

Measurements of the magnetoconductivity of a granular sample of $GdBa_2Cu_3O_{7-\delta}$ *(Gd-123)* in magnetic fields ranging from 0 to 500 Oe applied parallel to the current direction have been carried out by J. Roa-Rojas (Porto Alegre) et al. As the temperature is decreased, the resistive transition proceeds in two steps. The first transition is a pairing transition, which stabilizes superconductivity within the grains at a temperature practically coincident with the bulk critical temperature T_c. Analysis of the fluctuation contributions to the conductivity shows that the universality class for this transition is that of the three-dimensional (3D) XY model in the ordered case, with dynamical critical exponent z = 3/2.

The oxygen-order dependence of superconductivity in $YBa_2Cu_3O_{6.30}$ *has* been studied by P. Manca (Cagliari) et al. on sample pairs having the same oxygen content and thermal history but different $Cu(1)O_X$ chain arrangements. The pairs were found to be structurally and electronically nonequivalent because of different average chain lengths. The authors discuss their results in terms of the concept of a critical chain length for hole-doping efficiency.

Bi Cuprates

A preprint by S. Legner (IFW Dresden) et al. addresses the question of whether the topology of the normal-state Fermi surface of $Bi_2Sr_2CaCu_2O_{8+\delta}$ *(Bi-2212),* as seen in angle-resolved photoemission, depends on the photon energy used to measure it. The authors present high-resolution photoemission spectra and Fermi surface maps from pristine and *Pb*-doped *Bi-2212,* recorded using both polarized and unpolarized radiation of differing energies. The data show clearly that no main band crosses the Fermi surface along the ΓMZ direction in reciprocal space, even for a photon energy of 32 eV, thus ruling out the existence of a Γ-centered electron-like Fermi surface in *Bi-2212*. The true topology of the normal-state Fermi surface remains that of hole-like barrels centered at the X and Y points of the Brillouin zone.

According to a preprint by N. A. Tulina (Chernogolovka), the degraded surface of *Bi-2212* under a normal-metal point contact can demonstrate diode properties under certain conditions. The author finds that the current transport across such a boundary is hysteretic, indicating phase separation of the degraded surface into conducting and dielectric phases under the influence of an electric field.

As reported by W. Wong-Ng et al. (NIST-Gaithersburg), three types of liquid can be found in the *(Bi,Pb)-Sr-Ca-Cu-O* system: transient, metastable, and stable. The authors discuss (a) the role of the metastable liquid in the formation of the *(Bi,Pb)-2223* phase, (b) the primary phase (crystallization) fields, (c) interactions of *(Bi,Pb)-Sr-Ca-Cu-O* melts with *Ag,* and (d) melting as a function of oxygen partial pressure. A related preprint by L. P. Cook and W. Wong-Ng (NIST-Gaithersburg) examines the phase equilibria of *Ag* with *(Bi,Pb)-Sr-Ca-Cu-O* under various oxygen pressures.

Current-voltage characteristics in *Bi-2212* single crystals irradiated parallel to the c-axis with 5.8 GeV *Pb* ions have been investigated by L. Ammor (Tours) et al. For weak magnetic fields ($B < B_\phi$), where B_ϕ is the magnetic flux density at which the vortex density matches the columnar-defect density, the authors find that the isothermal I-V curves scale according to the Bose-glass theory. They obtain field- and sample-independent critical exponents $z' = 5.27 \pm 0.05$ and $\nu' = 1.30 \pm 0.07$.

Other Cuprates

Low-field dc magnetization measurements of the penetration depths λ_{ab} and λ_c as a function of temperature and magnetic field in single crystals of $Tl_2Ba_2CuO_{6+\delta}$ *(Tl-2201)* with various doping levels and T_cs are reported by Y. T. Wang and A. M. Hermann (Colorado). The authors found the temperature and field dependencies of λ_{ab} and λ_c to be linear for samples with $20\ K \le T_c \le 70\ K$, giving strong evidence for d-wave pairing and nodes in the superconducting gap. The data for optimally doped crystals with $T_c = 90$ K, however, show a quadratic temperature dependence. The authors emphasize that this feature is difficult to reconcile with known theories of s- or d-wave pairing.

A preprint by G. Kh. Panova (Kurchatov Institute) et al. reports measurements of the specific heat of single crystals of $La_{1.85}Sr_{0.15}CuO_4$ as a function of the magnitude and direction of an applied magnetic field **H**. The specific heat showed the dependence predicted for d-wave pairing: $H^{1/2}T$. The authors also observed a fourfold symmetry in the crystalline ab-plane, characteristic of the electronic density of states, and a twofold symmetry in the ac-plane. The results were found to be consistent with $d_{x^2-y^2}$ symmetry of the order parameter.

Measurements of the ^{139}La NQR spectra in a $La_2CuO_{4.02}$ single crystal have been carried out by E. G. Nikolaev (Leiden) et al. Decomposition of the spectra show the existence of three different La sites seen by NQR: oxygen-poor, oxygen-rich, and intermediate regions. This behavior is reminiscent of the *O*-doped macroscopically separated system and the *Sr*-doped glassy or striped La_2CuO_4 compounds.

Measurements of the ab-plane resistivity of $La_{2-x}Sr_xCuO_4$ single crystals with small *Sr* contents ($x = 0.052$-0.075) have been carried out by R. S. Gonnelli (Torino) et al. When the temperature was lowered, the authors found that the $\rho_{ab}(T)$ curves showed a transition from a linear behavior to a semiconducting one, with the deviation from linearity occurring at a doping-dependent temperature T_{ch}. The authors interpret this behavior as arising from a progressive pinning of preexistent charge stripes.

An enhancement of the irreversibility field H_{irr} for the n = 2 member of the *Hg-12(n-1)n* homologous series by optimizing the hole-density distribution has been achieved by T. Akao (Tokyo Tech) et al. The authors synthesized solid solutions of $HgBa_2(Ca_{1-x}Y_x)Cu_2O_{6+\delta}$ ($0 \le x \le 0.5$) using an encapsulation technique and then post-annealed the samples using a high-pressure oxidation (HPO) technique. The total amount of doped holes depends on both the amount of *Y* substitution for *Ca* (x) and the amount of excess oxygen in the HgO_δ layer (δ). The former reduces the hole density in the neighborhood of the CuO_2 planes, while the latter increases the amount of holes, especially in the charge reservoir block. Although the experimental data show that the best H_{irr} vs $(1-T/T_c)$ characteristics are obtained by overdoping the samples, the T_cs in such samples tend to decrease. The authors found, however, that samples simultaneously doped with small amounts of both yttrium and oxygen showed remarkably improved H_{irr} characteristics without a large suppression of T_c.

Vortices

Simultaneous transport and magnetization studies by B. Khaykovich (Weizmann Institute) et al. in Bi_2Sr_2Ca-$Cu_2O_{8+\delta}$ *(Bi-2212)* crystals at elevated currents have revealed large discrepancies, including finite resistivity at temperatures of 40 K below the magnetic irreversibility line. This resistivity, measured at the top surface, is nonmonotonic in temperature and is extremely nonlinear. The vortex velocity derived from magnetization is six orders of magnitude lower than the velocity derived from simultaneous transport measurements. These findings are attributed to a shear-induced decoupling, in which pancake vortices flow only in the top few CuO_2 planes and are decoupled from the pinned vortices in the rest of the crystal.

Three-dimensional molecular dynamics simulations of magnetically interacting pancake vortices have been used by C. J. Olson (UC-Davis) et al. to study vortex matter in disordered, highly anisotropic materials such as *Bi-2212*. As a function of the relative interlayer coupling strength, the authors observe a sharp 3D-2D transition from vortex lines to decoupled pancakes. The authors find an abrupt large increase in the critical current as the 3D-2D line is crossed in a direction corresponding to increasing H, with decoupled pancakes being much more strongly pinned. When the vortices are driven with the same current in each layer, the driving current being well above the depinning current, the authors find that the decoupled pancakes simultaneously recouple and reorder into a crystalline-like state.

The temperature dependence of the in-plane resistivity of *NbN/AlN* multilayer samples with varying insulating-layer thickness in magnetic fields up to 7 T parallel and perpendicular to the films has been studied by E. S. Sadki et al. (Cambridge). The upper critical field shows a crossover from 2D to 3D behavior in parallel fields. The irreversibility lines have the form $(1-T/T_c)^{\alpha}$, where α varies from 4/3 to 2 with increasing anisotropy. The results are consistent with simultaneous melting and decoupling transitions for a low-anisotropy sample, and with melting of decoupled pancakes in the superconducting layers for higher-anisotropy samples.

A 3D layered system of charges with logarithmic interactions parallel to the layers and random dipoles has been studied theoretically by B. Horovitz (Ben Gurion) and P. Le Doussal (Ecole Normale Supérieure) using a variational method. The results are relevant to vortex lattices. For layered superconductors with only magnetic interlayer coupling, the method predicts and locates a disorder-induced defect-unbinding transition in the vortex lattice.

The ac magnetic penetration depth $\lambda(T)$ in several high-T_c superconductors in the vortex state has been measured by R. Prozorov (Illinois-Urbana) et al. using an 11 MHz rf resonator. The authors found that $\lambda(T)$, measured after application of a dc field after zero-field cooling, does not coincide with the field-cooled $\lambda(T)$. The authors show that the observed irreversibility of $\lambda(T)$ yields important information about the pinning potential.

The second-order microwave response of $Ba_{0.6}K_{0.4}BiO_3$ *(BKBO)* crystals in the critical state has been investigated by M. Li Vigni et al. (Palermo). The authors found two related effects in the second-harmonic emission in intense pulsed microwave fields: a hysteretic behavior and a time decay of the second-harmonic signal intensity.

Magnetization measurements by Y. Radzyner (Bar-Ilan) et al. in an untwinned $YBa_2Cu_3O_{7-\delta}$ crystal have revealed a range of temperatures and fields for which the magnetization exhibits unusual history-dependent behavior. The range envelops the solid-solid transition line $B_{SS}(T)$ separating the vortex quasi-ordered and disordered phases. The observed history effects indicate that a disordered vortex state can exist as a metastable state below the $B_{SS}(T)$ line and a quasi-ordered vortex state can exist as a metastable state above the $B_{SS}(T)$ line. The fields defining the phase transition and the borders of the metastability region are correlated with sharp features in the magnetization loop.

The transformation of the vortex lattice in a tetragonal superconductor, consisting of a 45° reorientation relative to the crystal axes, has been studied by A. Knigavko (National Chiao Tung) et al. using the nonlocal London model. The authors find that the reorientation occurs as two successive second-order phase transitions. The transition fields are calculated for a range of parameters relevant to borocarbide superconductors, in which such reorientations have been observed. A closely related preprint by A. Knigavko and B. Rosenstein (National Chiao Tung) proposes an extension of this model to explain a recently observed 90° reorientation of the vortex lattice in borocarbide superconductors.

A preprint by M.-R. Li (Karlsruhe and Nanjing) et al. describes an expansion of the BCS free energy of a $d_{x^2-y^2}$-wave superconductor in the slowly varying superfluid velocity $\mathbf{v}_S$ and its gradients, and reports a study of the induced subdominant order parameters from T_c down to very low temperatures. The authors recover known results for a single isolated vortex in the Ginzburg-Landau regime, but they find that the behavior at low temperatures for subdominant components is qualitatively different. On this basis, the authors argue that predictions of a low-temperature phase transition in connection with recent thermal conductivity measurements are unlikely to be correct.

The mass per unit length μ and drag coefficient η for a Josephson vortex moving along an anisotropic Josephson junction have been calculated by M. W. Coffey (Colorado). The author also extends the approach to include the regime of relativistic vortex motion. The results should be applicable to the motion of either Josephson vortices along twin boundaries or intergranular Josephson vortices along grain boundaries.

Measurements of the remanent magnetization exhibited by three-dimensional disordered Josephson-junction arrays excited by an ac magnetic field are reported by W.A.C. Passos et al. (São Carlos). The arrays were fabricated from granular $YBa_2Cu_3O_{7-\delta}$. The effect, predicted by numerical simulations and previously observed in a low-T_c granular *Nb* array, occurs in a limited range of temperatures. The magnetized state can be excited and detected by two experimental procedures: a temperature-scan routine and a field-scan routine.

Surface Barriers

A generalized model of the critical state in a long superconducting strip, including the effects of both bulk and edge pinning, is presented in a preprint by A. A. Elistratov and I. L. Maksimov (Nizhny Novgorod). The authors determine the conditions for the penetration of Pearl-Abrikosov vortices into the superconductor, and they describe the resulting metastable flux structures. The authors also construct a diagram of different vortex states for a complete cycle of variations of an externally applied perpendicular magnetic field.

The field-dependent critical current $I_c(H)$ and current-voltage characteristics have been calculated by G. M. Maksimova et al. (Nizhny Novgorod) using a critical-state model that accounts for both surface barriers and bulk pinning as major irreversibility mechanisms in type-II superconductors. The calculations were carried out for the exactly soluble case of a thin-film superconductor, accounting for the Ginzburg-Landau nonlinearity of the order-parameter equation.

Starting from an analysis of the 2D Maxwell-London equation for a superconducting film in a perpendicular magnetic field, D. Yu. Vodolazov and I. L. Maksimov (Nizhny Novgorod) have derived a one-dimensional equation describing the distribution of the effective vector potential A(y) across the film width, which holds for both thin ($d < \lambda$) and thick ($d > \lambda$) films. The authors confirmed the validity of this equation by numerical analysis. They also derived approximate expressions for A(y) in the Meissner state and in the mixed state of a pin-free superconducting film with an edge barrier. The latter approximation permits the magnetic field at the film edge to be estimated as a function of the external magnetic field and geometrical parameters of the sample.

Theory

A preprint by Q. Si (Rice) discusses the question of what would be a definitive test of spin-charge separation. The author proposes a comparison of the temperature dependencies of both the spin resistivity and the electrical resistivity in the normal state of the high-T_c cuprates. Spin-charge separation would be manifested in different temperature dependencies of these two resistivities. The author estimates the spin diffusion length and spin relaxation time scales, and argues that it should be experimentally feasible to measure the spin transport properties in the cuprates using the spin-injection technique.

A mean-field spin-density-wave analysis of the pseudogap in the underdoped cuprates has been carried out by P. Lou (Anhui) and H.-S. Wu (USTC) using the t-t'-U Hubbard model. The authors find good agreement between their theory and earlier experiments, and thus they argue that the pseudogap phenomenon in the underdoped cuprates can be well understood within the mean-field approximation.

The dependence of the Maki-Thompson (MT) and density-of-states-depletion (DOS) contributions from superconducting fluctuations to NMR-NQR relaxation has been derived by P. Mosconi et al. (Pavia) in the framework of the diagrammatic theory and applied to layered three-dimensional high-T_c superconductors. By comparing their results with those of experiments using ^{63}Cu, the authors infer that a DOS contribution to the nuclear relaxation is present in the vicinity of T_c but that the MT term is more elusive.

The c-axis kinetic energy difference between the normal and superconducting states has been calculated by W. Kim and J. P. Carbotte (McMaster) for coherent and incoherent interlayer coupling between CuO_2 planes. For coherent tunneling, the authors find that the ratio of the missing conductivity spectral weight to the superfluid density is equal to one and that there is no violation of the conventional sum rule. For incoherent tunneling, on the other hand, the authors find that this ratio is always greater than one, whatever the nature of the impurity potential may be. To get a ratio less than one, as is observed in underdoped *YBCO* and other systems such as optimally doped *Tl-2201,* the authors suggest that it may be necessary to go to more exotic non-Fermi-liquid pseudogap models for the in-plane motion.

The superconducting properties of two-leg ladder compounds have been studied theoretically by M. Kohmoto and M. Sato (Tokyo). The authors conclude that these compounds have two sets of spin-triplet superconducting states without nodes in the gap, corresponding to the two sets of Fermi surfaces. These superconductivities are suppressed by antiferromagnetic (AF) fluctuations and may vanish if the AF fluctuations are strong enough.

The solution of a general problem in the magnetic force microscopy (MFM) of superconducting multilayers in the Meissner state is presented in a preprint by M. W. Coffey (Colorado). The author treats an arbitrary number of layers with a constant penetration depth λ_j within each layer. The author also discusses the possibility of future applications in the MFM inverse problem.

Overviews

An extensive review of the theory of vortex-glass phases in impure superconductors in an external field has been prepared by T. Nattermann and S. Scheidl (Köln). Topics reviewed include (a) the inclusion of thermal fluctuations in Ginzburg-Landau theory,

(b) directed elastic manifolds in a random potential, (c) superconducting films in parallel and perpendicular fields, (d) the Bragg glass in bulk superconductors, and (e) vortices driven far from equilibrium, i.e., moving lattice, moving smectic, and dynamic melting (303 refs.).

The chemical principles underlying the preparation of the high-temperature superconducting cuprates are reviewed in a preprint by Yu. D. Tretyakov and E. A. Goodilin (Moscow State). The authors discuss the crystal structures, physical properties, chemical behavior, phase diagrams, and oxygen nonstoichiometry of the cuprates. They discuss the development of advanced methods for the synthesis of the high-temperature superconductors, and they briefly describe a few practical applications of these materials (292 refs.).

Recent experiments on vortex avalanches in type-II superconductors and theoretical results from a corresponding simple cellular automaton (CA) model are reviewed by E. Altshuler (Havana). The author finds that the CA model contains the essential ingredients that unify avalanche dynamics displayed by superconducting and related mechanical systems (184 refs.).

A brief but practical review of the ac losses in high-temperature superconductors (HTS) has been prepared by C. M. Friend (BICC General Superconductors). Included are discussions of (a) hysteresis, coupling, and other loss components, (b) measurement techniques, (c) self-field losses due to a transport current, (d) losses due to applied magnetic fields, and (e) losses in more realistic situations (61 refs.).

A preprint by S. Lee (Tokyo Tech and Moscow State) et al. presents a brief overview of recent advances in the development of *Hg*-containing compounds for applications. The authors discuss (a) synthetic routes for precursor powder preparation, (b) modifications of the encapsulation technique, (c) searches for promising compositions via substitutions, (d) optimization of superconducting properties, and (e) preparation of materials prototypes using well-established technological processes (39 refs.).

The experimental status of the interlayer coupling in the cuprates has been reviewed by D. van der Marel et al. (Groningen). The authors compare the anomalous transport properties along the c-direction and the planar directions with results of model calculations based on strongly anisotropic scattering. An excellent description of the optical data at optimal doping is obtained if an anomalously large anisotropy of the scattering rate between cold spots and hot spots is assumed (29 refs.).

The current status of *$(Bi,Pb)_2Sr_2Ca_2Cu_3O_{10+\delta}$ [(Bi,Pb)-2223]* conductors for applications is assessed in a preprint by C. M. Friend et al. (BICC General Superconductors). Current leads constitute the only commercial market at this time, and the authors summarize the development by BICC General of 13 kA prototype leads for the LHC at CERN. The authors consider the physical parameters that determine the technical and economic performance of HTS conductors, and they suggest performance targets for these parameters for successful commercialization of HTS materials over the next five to ten years (19 refs.).

Ph.D. Thesis

The Ph.D. thesis of P. Starowicz (Jagiellonian) examines the transition from the insulating to the metallic and superconducting state in deoxygenated $R_{1-x}Ca_xBa_2Cu_3O_{6.1}$ systems *(R = Y* and *Eu).* The author discusses results obtained from x-ray diffraction, iodometric titration, scanning electron microscopy, electrical resistivity, magnetic susceptibility, Mössbauer studies, and photoemission. Because substitution of divalent *Ca* for trivalent *Y* or *Eu* increases the hole concentration, superconductivity could be achieved in tetragonal samples of deoxygenated $R_{1-x}Ca_xBa_2Cu_3O_{6.1}$ (116 refs.).

Contributed by John R. Clem

Contents:

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T. Akao, S. Lee, N. P. Kiryakov, H. Suematsu, K. Kurashima, and H. Yamauchi, "Hecto-Ångstrom Modulation and Peak Effect in Superconducting *(Hg,Pb)(Ba,Sr) -1223*." To be published in Physica C.

Contact H. Yamauchi, Materials & Structures Laboratory, Tokyo Institute of Technology, 4259 Nagatsuta, Midori-ku, Yokohama 227, JAPAN; phone +81 45 924-5315; fax +81 45 924-5365 or -5360; e-mail yamauchi@materia.titech.ac.jp. Key words: *Hg-1223,* cation substitutions, peak-effect phenomena, vortex pinning, compositional modulation, spinodal decomposition. 74.72.Gr; 74.60.Ec; 74.62.Bf; 74.80.-g.

T. Akao, S. R. Lee, K. Mizogami, H. Suematsu, and H. Yamauchi, "Irreversibility-Field Enhancement by Optimizing Hole Density Distribution in the *Hg-1212* Superconductor." To be published in Physica C. Contact H. Yamauchi, Materials & Structures Laboratory, Tokyo Institute of Technology, 4259 Nagatsuta, Midori-ku, Yokohama 227, JAPAN; telephone +81 45 924-5315; telefax +81 45 924-5365 or -5360; e-mail yamauchi@materia.titech.ac.jp. Key words: *Hg-1212,* cation substitutions, irreversibility field, hole density distribution, high-pressure-oxydation. 74.72.Gr; 74.60.Ec; 74.62.Dh.

E. Altshuler, "Vortex Avalanches in Type II Superconductors: The Sandpile Perspective." To be published in Some Contemporary Problems in Condensed Matter Physics, edited by Vlaev, Gaggero & Kostadinov (World Scientific, 2000). Superconductivity Laboratory, IMRE-Physics Faculty, University of Havana, 10400 Havana, CUBA. 74.60.-w.

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Kouji Yamawaki, Satoshi Sasaki, and Sergey Lee, "Single-Crystal X-Ray Study of *(Hg,Pb)-1223* Superconductor at Low Temperature." To be published in Physica C. Contact H. Yamauchi, Materials & Structures Laboratory, Tokyo Institute of Technology, 4259 Nagatsuta, Midori-ku, Yokohama 227, JAPAN; telephone +81 45 924-5315; telefax +81 45 924-5365 or -5360; e-mail yamauchi@materia.titech.ac.jp. Key words: *Hg*-based superconductor, x-ray diffraction, *Hg-1223* phase, temperature dependence, crystal structure.

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Hu Zhao, Jue-Lian Shen, and Z. X. Zhao, "Proximity Effect in Layered High-T_c Superconductors." To be published in Physica C (in press). Institute of Physics, Academia Sinica, P.O. Box 603-12, Beijing 100080, PEOPLE'S REPUBLIC OF CHINA; telephone +86 10 8264 9269; telefax +86 10 8264 9531; e-mail hzh@aphy.iphy.ac.cn. Key words: superconducting-normal-state layered structures, BCS model, high-T_c superconductors.

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*(An * indicates a previously listed event. Also see complete listing of upcoming conferences and workshops at our Web site http://www.iitap.iastate.edu/htcu/comevents.html.)*

*April 30 - May 3, 2000:

102nd Annual Meeting & Exposition Gateway to the New Millennium, St. Louis, Mo. This is the premier international forum for ceramics. Comprehensive coverage of ceramic and materials science, engineering, technology, manufacturing, and applications. The program will include symposia and focused programs: the symposia are designed to provide multidisciplinary perspectives on the nature and impact of state-of-the-art ceramic science, engineering, and technology in key areas, and the focused programming provides forums for in-depth technical exchange on specialized topics. Symposia will include ceramics and integrated components in microelectronics, optoelectronics, wireless communications and consumer electronics; ceramics for biological, chemical, mechanical, thermal and high-radiation applications; processing of ceramics; and cross-cutting symposia. For information, contact The American Ceramic Society, P.O. Box 6136, Westerville, OH 43086-6136; telephone (614) 890-4700; telefax (614) 899-6109; e-mail info@acers.org; Web site http://www.acers.org/.

*May 24 - 27, 2000:

Sixth Symposium on High Temperature Superconductors in High Frequency Fields (HTS-HF 2000), The Island of Capri, Naples, Italy. Organized by I.N.F.M. and Dipartimento Scienze Fisiche, and the University Federico. Aim of this biannual symposium is to bring together distinguished researchers involved in the study of the properties of high-temperature superconductors in rf and microwave fields, with emphasis on fundamental properties and material aspects, experimental methods, and market-emerging targets. Three areas have been identified as the main topics of the 2000 symposium: (1) Science and technology of HTS at microwave frequencies – new ideas and novel materials; correlation between microwave properties and material structure, morphology, defects, and impact on devices; nonlinear effects, harmonic generation and inter-modulation distortion in devices, and understanding and standardization of measurements. (2) Microwave applications of HTS – recent advances in telecommunication systems; tunable devices and totally agile superconducting systems; NMR and MRI applications; spatial probing; and cryopackaging issues. (3) Space applications of HTS – state of art of the North American and European programs. Scientific program will include keynote lectures supplemented by poster sessions, and ample time will be given to discussions and socialization. Participation is by invitation only and is presently limited to about 80 attendants. For information, contact Annamaria Mazzarella, Conference Secretariat; telephone +39 081-8534123 or -8661381; telefax +39 081-5267654; e-mail cib@secyann.cib.na.cnr.it.

July 17 - 19, 2000:

2000 Superconductivity Program Peer Review, Loews L'Enfant Plaza Hotel, Washington, D.C. The proposed agenda and on-line registration will be available soon at http://www.eren.doe.gov/superconductivity/calendar.html.

*Sept. 17 - 22, 2000:

The Applied Superconductivity Conference (ASC 2000), Pavilion Convention Center, Virginia Beach, Va. Premier conference on applied superconductivity held every two years. The meeting will highlight the latest developments and will feature invited presentations that offer an exciting look into the future. Papers to be presented in three general areas of superconductivity: large scale, materials, and electronics. Further information available at the Web site http://www.ascinc.org.

Nov. 13 - 17, 2000: Eighth Conference on Frontiers of Electron Microscopy in Materials Science (FEMM2000) – Bridge to 21th Century's Electron Microscopy, Matsue, Japan. Conference will provide an international forum on advanced electron microscopy for materials science problems, and intends to contribute to the progress of new century's electron microscopic techniques. Topics of Interest: 1) toward ultra-high-resolution transmission electron microscopy with sub-angstrom resolution; 2) high-resolution electron energy loss spectroscopy with sub-eV resolution; 3) spectrum imaging and energy filtered imaging techniques; 4) dynamic observation techniques, including irradiation effects; 5) surfaces and ultra high-vacuum transmission electron microscopy; 6) electron holography and Lorentz microscopy; 7) high-resolution scanning transmission electron microscopy; 8) cathodoluminescence; 9) computational electron microscopy. Technical sessions will include invited and contributed papers. Proceedings will be published as a regular issue of a noted microscopy or materials science journal. **Abstract deadline, August 31, 2000.** For further information, contact M. Takeguchi or K. Mitsuishi, National Research Institute for Metals, 3-13 Sakura, Tsukuba 305-0003, Japan; telephone +81 298 59-5055 or -5053; telefax +81 298 59-5010; e-mail femm2000@nrim.go.jp; Web site http://www.nrim.go.jp/femm2000.

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New Reference: *Handbook of Nanostructured Materials and Nanotechnology,* edited by Hari Singh Nalwa. Nanostructured materials and technologies have opened up exciting new possibilites for future applications in a number of areas including aerospace, automotive, x-ray technology, batteries, sensors, color imaging, printing, computer chips, medical implants, pharmacy, and cosmetics. The ability to change properties on the atomic level promises a revolution in many realms of science and technology. This book details the high level of activity and significant findings that are available for those involved in research and development in the field. Also covers industrial findings and corporate support. This five-volume set summarizes fundamentals of nanoscience in a comprehensive way. Publ. 1999; price $1300; ISBN 0125137605. Contact Order Fulfillment Department, Academic Press, 6277 Sea Harbor Drive, Orlando, FL 32887; telephone (800) 321-5068 or (407) 345-3800; telefax (800) 874-6418 or (407) 345-4060; email ap@acad.com.

Book: *Electrodynamics of Solids and Microwave Superconductivity,* by Shu-Ang Zhou. Presents the interdisciplinary field of solid electrodynamics and its applications in superconductor and microwave technologies. Book gives scientists and engineers the foundation necessary to deal with theoretical and applied electromagnetics, continuum mechanics, applied superconductivity, high-speed electronic circuit design, microwave engineering, and transducer technology. Publ. 1999; 626 pp.; price $130; ISBN 0-471-35440-6. Contact John Wiley & Sons, Inc., Distribution Center, 1 Wiley Drive, Somerset, NJ 08875-1272; telephone (732) 469-4400 or (800) 225-5945; telefax (732) 302-2300; e-mail catalog@wiley.com; Web site http://catalog.wiley.com.

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Position open: The Solid State Division at Oak Ridge National Laboratory invites applications for a Postdoctoral Research Associate position in the area of HTS conductor development. The successful candidate must have a Ph.D. in either physics or materials science with a working knowledge of high-temperature superconducting materials and materials characterization, including x-ray diffraction, electron microscopy, and transport measurements. Previous experience in superconducting tape and/or epitaxial film growth is preferred. The successful candidate must have an interest in HTS applications as this position will involve significant interaction with industry. Position available immediately. Applications are encouraged from women and minority candidates. Applicants should send a complete CV, publication list, copies of transcripts, and a brief indication of research interests, together with the names and addresses of at least three references (good quality hard copies of these materials are required, e-mail alone is not acceptable), to Dr. D. H. Lowndes, Solid State Division, Oak Ridge National Laboratory, P.O. Box 2008, Oak Ridge, TN 37831-6056.

Position open: Postdoctoral position available at Oak Ridge National Laboratory, to participate in the coated-conductor-development program. Background in high-temperature superconducting materials and experience in film deposition by vapor and/or chemical precursor methods desirable. For information contact Dr. Donald M. Kroeger, Superconducting Materials Group, Metals and Ceramics Division, Oak Ridge National Laboratory, Oak Ridge, TN 37831-6116; telephone (865) 574-5155; telefax (865) 574-7659; e-mail kroegerdm@ornl.gov.

Position open: A postdoctoral position will be available from October, 2000 at the National Research Institute for Metals in Japan, for work involving computer simulations on the vortex physics of high-T_c superconductors and related topics. Length of position: up to two years; salary: 270,000-320,000 Yen per month; allowances for housing, family, relocation, travel to international and domestic conferences, and some research funds. **Application deadline, May 6, 2000.** Contact Dr. Xiao Hu, Group Leader, Computational Materials Science Division,

National Research Institute for Metals, Sengen 1-2-1, Tsukuba 305-0047, Japan; telephone +81 298 59 2627; telefax +81 298 59 2601; e-mail xhu@nrim.go.jp.

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