

MS10.05.05 HIGH PRESSURE AND LOW TEMPERATURE STUDY OF THE LTO TO LTT PHASE TRANSITION IN $\text{La}_{1.875}\text{Ba}_{0.125}\text{CuO}_4$. R. L. Harlow, M. K. Crawford, E. M. McCarron, CRD, The DuPont Company, Wilmington, DE 19880-0228; S. W. Tozer, NHFML, Florida State University, Tallahassee, FL 323064005; D.E. Cox, Q. Zhu, T. Vogt, Dept. of Physics, Brookhaven National Laboratory, Upton, NY 11973; J. D. Jorgensen, Materials Science Division, Argonne National Laboratory, Argonne, IL 60439

We have performed a high pressure, low temperature x-ray diffraction study of the LTO (Bmab) to LTT ($P4_2/ncm$) structural transition in $\text{La}_{1.875}\text{Ba}_{0.125}\text{CuO}_4$. This phase transition leads to a drastic suppression of superconductivity which is not yet understood. The reported partial restoration of superconductivity under pressure stimulated our study. The structural work was performed using a Merrill-Bassett diamond anvil cell with a 4:1 methanol to ethanol pressure medium. The hydrostatic nature of this medium at pressures as high as 68 kbar and temperatures as low as 15 K was confirmed by the fact that the diffraction linewidths were limited by the position-sensitive detector resolution of 0.04 degrees. Measurements at a number of temperatures and pressures suggest that pressure first stabilizes a Pccn low-temperature phase. Higher pressures lead to the I_4/mmm (HTT) high temperature phase becoming stable at all temperatures from 300 K to 15 K. The results suggest that there is no suppression of superconductivity in the HTT phase at a doping level of 1/8 hole per Cu atom.

MS10.05.06 STRUCTURE MODIFICATION TO INCREASE FLUX PINNING IN Hg-Ba-Ca-Cu-O SUPERCONDUCTORS. J. D. Jorgensen, O. Chmaissem, D. N. Argyriou, D. G. Hinks, P. Guptasarma, Materials Science Division and Science and Technology Center for Superconductivity, Argonne National Laboratory, Argonne, IL 60439; J. Shimoyama, K. Kishio, Department of Applied Chemistry, Univ. of Tokyo, Bunkyo-ku, Tokyo 113, Japan; K. Yamaura, Z. Hiroi, M. Takano, Institute for Chemical Research, Kyoto Univ., Uji, Kyoto-Fu 611, Japan; B. G. Storey, H. Zhang, L. D. Marks, Y. Y. Wang, V. P. Dravid, Dept. of Materials Science and Engineering and Science and Technology Center for Superconductivity, Northwestern Univ., Evanston, IL 60208; B. Dabrowski, Physics Dept., Northern Illinois Univ., DeKalb, IL 60115

Chemical substitution of Cr or Re on the Hg site and Sr on the Ba site has been used to enhance the flux pinning of Hg-Ba-Ca-Cu-O superconductors. The structural modifications have been characterized by neutron powder diffraction and electron diffraction and microscopy. Three features of the modified structures are thought to influence the flux pinning. Increased coupling of pancake vortices to form vortex lines can result from either shortening or metallization of the blocking layer. Extended defects that can pin flux can be formed as a result of the substitutional defects. This work suggests that such techniques can be used to increase the usefulness of these materials for bulk current-carrying applications.

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MS10.05.07 OXYGEN CONTENT AND TWEED/TWIN TRANSITION OF $\text{YBa}_2\text{Cu}_{3-x}\text{Al}_x\text{O}_{6+y}$ SINGLE CRYSTALS Schmahl¹, W. W. Wruck¹, B. Brecht², E. Wolf², Th. Andersen³, N. H. Rodewald⁴, M., Miede⁴, G. Fueß⁴, H. ¹Institut fuer Mineralogie, Universitaet Tuebingen, Germany, ²INFP, FZ Karlsruhe, Germany, ³Riso Natl. Laboratory, Denmark, ⁴FB Materialwissenschaft, TH Darmstadt, Germany.

Our single-crystal neutron and x-ray diffraction data show that Al^{3+} substitution on the Cu(1)-'chain'-site of the YBCO-structure significantly decreases the oxygen-content y in the basal layer compared to pure material prepared under identical conditions in O_2 -atmosphere (e.g. $\text{YBa}_2\text{Cu}_3\text{O}_{6.98} \leftrightarrow \text{YBa}_2\text{Cu}_{1.8}\text{Al}_{0.2}\text{O}_{6.71}$). In reducing conditions, however, the Al^{3+} ions pin excess oxygen in the basal layer (e.g. $\text{YBa}_2\text{Cu}_{1.8}\text{Al}_{0.2}\text{O}_{6.25}$ compared to $\text{YBa}_2\text{Cu}_3\text{O}_{6.05}$ for the pure material). Both facts are a consequence of tetrahedral coordination of Al^{3+} , which persists even in extremely reducing conditions and limits the correlation-length of the ortho-I chains in the fully oxidized structure. The oxidized as-grown crystals show a macroscopically tetragonal tweed-structure. If these crystals are annealed in reducing atmospheres above 950 K, they develop ortho-I long-range order and lamellar {110}-type twinning during reoxidation at 673 K. The transition between tweed- and lamellar twin-structure is reversible: the tweed-structure is restored in the long-range ordered, twinned crystal by annealing in oxygen atmosphere above 950 K. The orthorhombicity of the reoxidized material decreases with decreasing temperature of the reduction treatment prior to reoxidation. The effect can be attributed to clustering of the AlO_n defects in reducing conditions and declustering in oxidizing conditions with a kinetic cutoff-temperature of 950 K for these diffusion processes. Computer simulations show that clustering allows ortho-I long-range-order because (i) the mean defect-free area is increased, and (ii) most of the relevant clusters are neutral with respect to the ortho-I domain orientation.

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MS10.05.08 CRYSTALLIZATION FIELD INVESTIGATION OF THE (Bi, Pb)-Sr-Ca-Cu-O SYSTEM. Lawrence P. Cook, Winnie Wong-Ng, Ceramics Division, National Institute of Standards and Technology, Gaithersburg, MD 20899

Knowledge of melting equilibria in the system Bi-Sr-Ca-Cu-O is important for processing of superconductor tapes and wires, and for melt growth of single crystals. Experimental difficulties associated with the melting studies of the copper containing high T_c superconductor phases are corrosion of containers and atmospheric contamination. Furthermore, the large crystals formed during quenching of melt render the determination of primary crystals and melt compositions difficult. By using a wicking technique to capture the melt and performing quantitative microchemical analysis, melt compositions have been obtained for important melting reactions involving four or five solids. This data allows construction of the multidimensional crystallization fields for various solids in the system.

Discussion will include melt evolution of the Bi-Sr-Ca-Cu-O system, approximate crystallization fields of the "2122" and "2223" high T_c phases, and melting characterization of the Raveau phase (commonly referred to as the "2201" phase). The effect of Ag addition on melting equilibria will also be discussed.