Abstract Submitted
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Novel Superoxygenated Phases in Superconducting Cuprate Thin Films[1] C. ZHANG, H. ZHANG, University of Toronto, N. GAUQUELIN, G. A. BOTTON, Canadian Centre for Electron Microscopy & Brockhouse Institute for Materials Research, C. MCMAHON, D. G. HAWTHORN, University of Waterloo, J. Y. T. WEI, University of Toronto & Canadian Institute for Advanced Research — The superconducting critical temperature (T_c) of hole-doped cuprates tends to increase with their lattice complexity, which is generally correlated with higher states of oxidation. For $YBa_2Cu_3O_{7-\delta}$ (YBCO-123), it is known that solid-state reaction in high-pressure oxygen can induce the formation of more complex and oxidized phases such as $Y_2Ba_4Cu_7O_{15-\delta}$ (YBCO-247) and $Y_2Ba_4Cu_8O_{16}$ (YBCO-248). In this work, we apply this superoxygenation concept of material synthesis to nanoscale thin films which, owing to their large surface-to-volume ratio, are more thermodynamically reactive than bulk samples. Epitaxial thin films of YBCO-123 were grown by pulsed laser deposition on $(La, Sr)(Al, Ta)O_3$ substrates, and post-annealed in up to 500 atm of oxygen at 800C. Our post-annealed films show robust superconducting transitions with T_c ranging from 80 to 93K. Transmission electron microscopy and X-ray absorption spectroscopy were used to probe the lattice structure and oxygen stoichiometry. Our measurements show clear evidence of conversion to YBCO-247 and YBCO-248 in the superoxygenated films, as well as YBCO-125, a novel YBCO phase that has three CuO chains per unit cell and potentially higher T_c.

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