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Controlling hole concentration in superconducting $YBa_2Cu_3O_{7-\delta}$ thin films for spectroscopic studies* MATTHEW BRINKLEY, WAN KYU PARK, XIAOFANG ZHAI, JAMES ECKSTEIN, LAURA GREENE, University of Illinois at Urbana-Champaign, UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN COLLABORATION — One of the remaining controversial issues in the high-T_c cuprate superconductors is whether the d-wave order parameter is robust over the whole doping range. As an essential first step to address this, we optimize a growth procedure for high-quality sputter-deposited $YBa_2Cu_3O_{7-\delta}$ thin films with various hole concentrations by controlling the oxygen content (and by cation doping in the future). Two different approaches have been attempted successfully: annealing in an oxygen-controlled environment and ozonization. We have developed an *in-situ* annealing procedure employing two-step post-deposition anneals in vacuum and O_2. The oxygen content is estimated from high-resolution x-ray diffraction data. This procedure produces high-quality thin films, optimally doped (e.g., 7-δ $\approx$6.88, $T_{c,on}$=91.8 K, and ΔT_c <0.9 K) and underdoped (e.g., 7-δ $\approx$6.43, $T_{c,on}$=55.1 K, and ΔT_c <2.9 K). Preliminary ozonization experiments show that varying the oxygen content in a controlled manner is feasible, especially in the overdoped regime. We will present detailed transport measurements, materials characterizations, and some initial conductance spectra from planar tunneling and Andreev reflection spectroscopies. *Supported by the U.S. DoE Award No. DEFG02-91ER45439 through the FSMRL and the CMM at UIUC.

Matthew Brinkley
University of Illinois at Urbana-Champaign

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