Tunneling Spectroscopy on $c$-axis $Y_{1-x}Ca_xBa_2Cu_3O_{7-\delta}$ Thin Films: Evidence for Multiband Superconductivity

J.H. NGAI, University of Toronto, W.A. ATKINSON, Trent University, J.Y.T. WEI, University of Toronto — We report scanning tunneling spectroscopy measurements on \{001\} oriented $Y_{1-x}Ca_xBa_2Cu_3O_{7-\delta}$ thin films at $x = 0$, 0.05, 0.15 and 0.20 Ca-doping at 4.2K. The tunneling spectra exhibit main-gap, sub-gap and satellite features which we analyze using a generic multiband tunneling model that accounts for the separate contributions of the plane and chain bands to the tunneling conductance spectrum. Our analysis indicates the sub-gap features could arise from the chain band density of states, while the satellite features could come from the plane band for a $d_{x^2-y^2} + s$ pairing symmetry. The doping dependent evolution indicates that all three spectral features are set by a single parameter $\Delta_0$, which monotonically decreases with Ca-doping, suggesting that superconductivity in $Y_{1-x}Ca_xBa_2Cu_3O_{7-\delta}$ involves multiple bands.

This work supported by NSERC, CIAR

Joseph Ngai
University of Toronto

Date submitted: 30 Nov 2006

Electronic form version 1.4