Electronic inhomogeneities in superconducting $\text{YBa}_2\text{Cu}_3\text{O}_{6+x}$

FERENC STERCEL, Dept. of Materials Science and Engr., University of Pennsylvania, JAE-HO CHUNG, NIST, TAKESHI EGAMI, Dept. of Physics and Astronomy and Department of Materials Science and Engineering, University of Tennessee-Knoxville, MASATOSHI ARAI, TETSUYA YOKOO, HYUNGJE WOO, Dept. of Physics and Astronomy, University of Tennessee-Knoxville, MOHANA YETHIRAJ, HERB A. MOOK, ORNL, CHRIS D. FROST, Rutherford Appleton Laboratory, UK, FATIH DOGAN, Dept. of Materials Science and Engr., University of Missouri-Rolla — There has been an increasing amount of experimental evidence for the presence of local electronic inhomogeneities in superconducting cuprates. Inelastic pulsed neutron scattering measurements on $\text{YBa}_2\text{Cu}_3\text{O}_{6+x}$ single crystals with different oxygen concentrations show that the zone boundary softening of the in-plane LO Cu-O bond stretching mode is the same for all doping levels. In addition, the spectral weight of the softened mode increases with increasing doping. This indicates that there is a microscopic electronic phase separation in superconducting $\text{YBa}_2\text{Cu}_3\text{O}_{6+x}$. Furthermore, triple axis inelastic neutron scattering measurements on the underdoped $\text{YBa}_2\text{Cu}_3\text{O}_{6.6}$ performed at different temperatures revealed that a new local mode appears at 65 meV at higher temperatures (200 K and above). It might indicate the presence of polarons.

Ferenc Stercel
Department of Materials Science and Engineering,
University of Pennsylvania, Philadelphia, Pennsylvania 19104

Date submitted: 05 Dec 2005

Electronic form version 1.4