Electronic structure of Tl-2201 and Ti-2212 studied resonant soft-x-ray emission spectroscopy (RXES)

J.-H. Guo, S. M. Butorin, C. McGuinness, J. Downes, K. Smith, H. Chen, L.-G. Johansson, and J. Nordgren
LBNL, University of California, Berkeley, CA 94720
Dept. of Phys., Boston Univ., Boston, MA 02215
Dept. of Inorg. Chem., Chalmers Univ. of Tech., 412 96 Gotenburg, Sweden
Dept. of Phys., Uppsala Univ., 751 21 Uppsala, Sweden

The finding about predominantly O 2*p* character of charge-carriers has led to a discussion on the role of inequivalent O atoms, existing in cuprate lattices, in the high-*Tc* superconductivity phenomenon. The Cu–O octahedra is identified as a key element so that the importance of in-CuO-plane and apical oxygen and their different Cu–O bonds is debated. RXES is a powerful method for electronic structure studies, complementing standard methods such as valence band photoelectron spectroscopy. RXES is subjected to a revived interest due to the new possibilities offered by the synchrotron radiation sources. We have studied Tl-2201 films with both oxygen over-doping and under-doping compositions and one Tl-2212 film. By tuning photon energy to specific edges we have enhance excitation of one particular chemically shifted species, such as separating in-plane and out-of-plane oxygen. By studying the effect of doping, which induces the superconductivity, we observe the localization and symmetry of doping induced hole states. The band narrowing and shift are also observed in RXES spectra at 20K.

5. Superconductivity

5.4 Electronic Structure and Spectroscopic Properties