Copper K-edge resonance in a one dimensional cuprate

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We have studied incident energy and momentum dependence in the inelastic scattering channel of the quasi-one dimensional cuprate $SrCuO_2$. Resonance features associated with copper 1s-4p and 1s-3d core excitations are observed in the 8.977-9.007eV incident energy range.

Keywords: RIXS, cuprate, one dimensional

1. Purpose

The purpose of our experiment was to study the copper k-edge intermediate resonance states of quasi-one dimensional $SrCuO_2$ by measuring the inelastic scattering signal over a range of transferred momenta and incident energies near the copper K-edge. Due to its low (quasi-one) dimensionality, $SrCuO_2$ is one of the simplest cuprate systems to model numerically, and represents an excellent foundation for understanding the resonance process in resonant inelastic X-ray scattering (RIXS).

2. Method

X-ray absorption spectroscopy and inelastic scattering measurements were performed over a wide range of incident energies close to the copper K-edge using the BL11XU inelastic scattering spectrometer. Incident polarization was maintained in the copper-oxygen plaquette plane for all RIXS measurements.

3. Result

X-ray absorption spectroscopy and rapid inelastic scans were performed over a wide range of incident energies close to the copper K-edge (8.977 – 9.007keV), revealing low energy resonance enhancement associated with the Cu 1s-4p excitation in the 8.988–9.005keV incident energy range and a "d-d" prepeak at 8.979keV. Momentum was studied in the 1D Brillouin zone center and at the zone boundary for all incident energies, and incident polarization was maintained in the copper-oxygen plaquette plane. After these measurements were completed, careful study was made of the momentum dependence at specific incident energies, showing dispersion similar to previous observations [1, 2].

4. Conclusion

Incident energy dependence of inelastic scattering near the copper K-edge in $SrCuO_2$ has been successfully studied with momentum resolution across the full Brillouin zone for prominent spectral features. In spite of strong enhancement, no systematic dispersion was observed in the "d-d" prepeak feature.

5. Reference

1. Y-J. Kim *et al*, Phys. Rev. Lett. **92**, 137402 (2004).
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