

Copper k-edge prepeak resonance in a one dimensional cuprate

Lewis WRAY¹⁾, Matthew XIA¹⁾, Kenji ISHII²⁾, Zahid HASAN¹⁾

¹⁾Princeton University ²⁾SPring-8 BL11XU

Polarization dependence in the copper k-edge prepeak and other resonance modes of the quasi-one dimensional Mott insulator SrCuO₂ was studied as part of an ongoing project to understand polarization and incident energy dependence in resonance inelastic x-ray scattering (RIXS). Two inelastic features were observed at the prepeak, with negligible dispersion in the copper-oxygen chain direction.

Keywords : RIXS, cuprate, prepeak, one dimensional

1. Purpose

We continued a systematic study of the copper k-edge intermediate resonance states in quasi-one dimensional SrCuO₂ under new polarization conditions, focusing on the absorption prepeak and other intense resonance modes. Previous measurements at SPring-8 and the APS had revealed several significant polarization dependent features and unorthodox polarization dependence in the d-d excitation mode.

2. Method

X-ray absorption spectroscopy and inelastic scattering measurements were performed at selected incident energies and polarization geometries over a wide range close to the copper K-edge using the BL11XU inelastic scattering spectrometer. Three crystal faces were tested to achieve the desired scattering conditions and assess the effect of incident and outgoing absorption on the scattering signal.

3. Result

X-ray absorption spectroscopy and rapid energy loss scans were performed at selected incident energy and polarization conditions at the copper k-edge. Inelastic measurements were performed at 8.979, 8.985, 8.992, and 8.999keV, with polarization tested systematically in steps of 5° within the Cu-O plaquette plane and approaching the perpendicular from the chain direction. Intensity in the “d-d” prepeak at 8.979keV was greatest in the Brillouin zone center, and observed dispersion in the chain direction was negligible, with no sign of the π/a periodicity suggested in reference [1].

4. Conclusion

The resonance enhancement of prominent inelastic modes, including the “d-d” prepeak, was studied over a wide range of incident polarization conditions. Two inelastic features were observed at the prepeak, with centroids at 2.4eV and ~4.5eV.

5. Reference

1. J. W. Seo *et al*, Phys. Rev. B **73**, 161104R (2006).