



	Experiment title: Study of Local Structural Disorder in the Stoichiometric and Non-stoichiometric Sr ₂ RuO ₄ Perovskite System by polarized EXAFS	Experiment number: HS1348
Beamline: BM29	Date of experiment: from: 14 February 2001 to: 19 February 2001	Date of report: 28.02.02
Shifts: 15	Local contact(s): Dr. Michael BOROWSKI	<i>Received at ESRF:</i>
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Report:

The proposed work was focussed to investigate the local lattice structure of the RuO₂ in a layered perovskite type oxide Sr₂RuO₄ exhibiting superconductivity at low temperature. During the available beamtime, X-ray absorption measurements were performed at the Ru K-edge of the title system, at 22117 eV. The measurements were performed on single crystals samples with polarized light falling parallel to the in-plane (E//ab) and out of plane (E//c) of the RuO₆ octahedra. We measured both Ru K-edge XANES and Ru K-edge EXAFS in the two geometries. A temperature dependence of the E//ab Ru K-edge was performed using 13 element fluorescence detector. The Si(311) monochromator was used to obtain high energy resolution and high flux in the energy range of interest for the present experiment. For temperature dependent measurements the samples were mounted in a closed cycle two stage He cryostat. The measurements were performed at several temperatures in the range of 20-300 K.

The emphasis was given to measure the spectra with a high signal to noise ratio and several scans were collected to limit the noise level to the order of 10^{-4} .

The analysis of the Ru K-edge XANES provides local geometrical change as a function of temperature and is more sensitive to the any rotation of the RuO_6 octahedron in this compound. Ru K-edge XANES spectrum of the Sr_2RuO_4 system measured in the in plane polarization ($E//ab$) is shown in Fig. 1. The spectrum shows several structures in the near edge region. The origin of different XANES peak is being studied by multiple scattering calculations.

By study of the peak intensities of the XANES peaks, we find at least two temperatures where the local geometrical changes occurs in the system, a temperature around 140 K and a small change around 50 K. A detailed analysis of the XANES is underway.

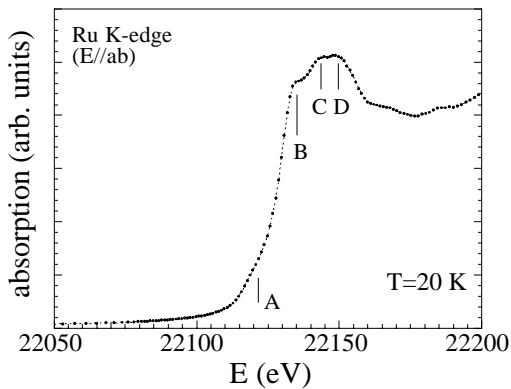


Fig. 1. $E//ab$ Ru K-edge XANES spectrum of the Sr_2RuO_4 system.

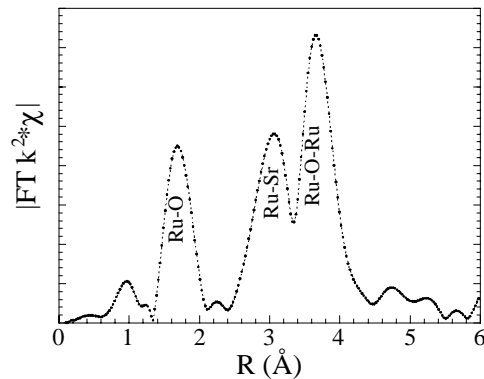


Fig. 2. Magnitude of the Fourier transform of the Ru K-edge $E//ab$ EXAFS spectrum.

Standard procedure was used to extract the EXAFS signal and corrected for the x-ray fluorescence self-absorption before the analysis. Fig. 2 shows the Fourier transform of the EXAFS spectrum measured at a representative temperature. A preliminary analysis of the temperature dependence of the EXAFS shows clear indications of anomalous local lattice displacements in the RuO_6 octahedra, consistent with qualitative change observed in the local geometry of system, measured by XANES. Detailed analysis of the XANES and EXAFS data and interpretation of the anomalous behavior of the local lattice displacements (with respect to the diffraction studies measuring average structure) are underway and the results are to be communicated for publication.

Due to insufficient time, the measurements were performed only on the stoichiometric system. The non stoichiometric system has yet to be measured for completing the proposed experiments to reveal interplay between local lattice displacements and the superconductivity in the title compound.