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Soft X-ray Magnetic Circular Dichroism Study of $SrRuO_3$ thin films

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1.INTRODUCTION: $SrRuO_3$ (SRO) is a ferromagnetic metal with a relatively high Curie temperature of Tc ~ 160 K and it is a 4d transition metal oxide with a perovskite-type structure, The electrical resistivity does not saturate even above 500 K, where the Ioffe Regel limit is exceeded [1,2], indicating a highly incoherent nature of the metallic state, i.e., a so-called "bad metallic" behavior. From a device application point of view, SRO is a promising material, e.g., as electrodes, because of its chemical stability and its structural compatibility with many functional oxides.

2.EXPERMENTAL**:** The purpose of the present study is to understand magnetic properties of the SRO thin films grown on $SrTiO_3$ (001) STO(001) substrates through the measurements of the spin and orbital magnetic moments using x-ray magnetic circular dichroism (XMCD). 16 nm SRO thin films were fabricated on STO(001) substrates by the MBE method with precise control of the thickness. X-ray absorption spectroscopy (XAS) and soft x-ray magnetic circular dichroism (XMCD) measurements were performed at the undulator beamline BL-16A of Photon Factory, KEK.

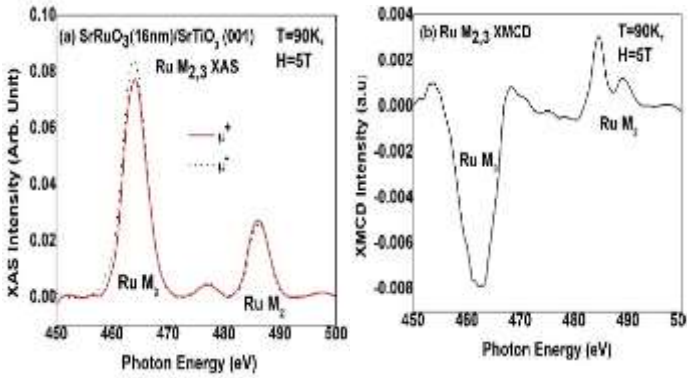

Fig 1. Ru $Mn_{2,3}$-edge of 16 nm SRO/STO (001) taken in the TEY mode at T=90K and H=±5 T. (a) XAS. (b) XMCD spectra

3.RESULTS AND DISCUSSIONS: Figure 1 shows the Ru $M_{2,3}$ XAS and XMCD spectra of the 16nm SRO films at a magnetic field of H = ±5.0 T at 90K. For the 16 nm thick SRO film, clear Ru $M_{2,3}$ XAS and XMCD spectra were observed. Taking the difference between the XAS spectra for right and left circularly polarized light, we have obtained the XMCD spectra as shown in the bottom panels of Figs. 1(b). Using sum rule have observed m_{spin} and m_{orb} was 0.7μ_B/Ru and 0.11 μ_B/Ru respectively. Ru $M_{2,3}$-edge XMCD spectra of SRO films with various magnetic field suggest that our sample is ferromagnetic which show strong XMCD signals at 90K while no XMCD signals at 300K. We also observed that the XMCD intensity slightly decreases with decreasing magnetic field.

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