

ELECTRONIC STRUCTURE OF EPITAXIAL SrRuO₃ FILMS STUDIED BY RESONANT PHOTOEMISSION

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SrRuO₃ (SRO) epitaxial films are an important material with outstanding electrical and magnetic properties and as electrode for electronic devices, including dynamic random access memories [1-3]. The surface crystallographic structure and chemical states of SRO is very sensitive to the sample preparation method and subsequent treatment conditions [4].

In this work the resonant photoemission spectroscopy was used to study the electronic structure of SRO epitaxial films followed by postannealing at moderate temperatures in super high vacuum. The resonant photoemission experiment was performed in the synchrotron radiation laboratory HASYLAB, Hamburg (Germany). Synchrotron radiation obtained from the storage ring DORIS III was monochromatized with the FLIPPER II plane grating vacuum monochromator designed for the photon energy range of 15–100 eV. The spectrometer was equipped with a CMA electron energy analyzer. The total energy resolution was kept at 0.1 eV. The origin of the energy axis was set at the Fermi energy as measured for a reference metallic sample.

Thin SrRuO₃ films were deposited using a reactive d.c. magnetron sputtering onto monocrystalline (100)-plane oriented SrTiO₃ substrates. The sputtering was performed in Ar and O₂ mixture (1:1) at pressure of about 15 Pa. The substrate temperature was set at 650 °C. Thickness of the films was ~0,1 μm.

Ru 4d (see Fig. 1) and O 2p partial density of state (DOS) of SrRuO₃ film was derived from photoelectron spectra measured both in EDC (energy distribution curve) mode and CIS (constant initial state) mode under Ru 4p → 4d photo-excitation and using the photoionization cross-sections of Ru 4d and O 2p dependence on the incident photon energy.

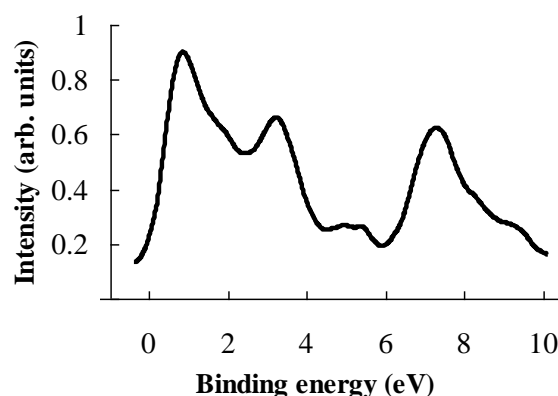


Figure 1 Experimentally deduced Ru 4d partial DOS of SrRuO₃ epitaxial films followed by postannealing in high vacuum at 300 °C

The results confirm the strong hybridization between Ru 4d and O 2p orbitals in SRO epitaxial films.

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