Characterization of structural, magnetic and transport properties of $SrRuO_3$ thin films and $YBa_2Cu_3O_{7-x}/SrRuO_3$ heterostructure

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Proximity effects in Ferromagnet/Superconductor Heterostructures (F/S-H) have demonstrated high potential for development of new devices for spintronic and quantum computing application. $SrRuO_3$ (SRO) has attracted much attention among transition metal oxides for being the only 4d oxide to show itinerant ferromagnetism and metallic conductivity. On the other side, $YBa_2Cu_3O_{7-x}$ (YBCO) is one of the most studied high T_c superconductors with a large variety of application for devices [1, 2]. In this work, we aim to characterize the crystal structure as well the magnetic and transport properties of SRO thin films and SRO/YBCO heterostructure, with further investigation of proximity effects with Neutron Scattering and X-ray spectroscopy. The samples were prepared on low miscut $SrTiO_3$ (001) single crystals by High-Oxygen Pressure Sputtering. SRO thin films are epitaxial and have low surface roughness. Magnetometry indicates that samples have out-of-plane magnetic anisotropy and paramagnetic-ferromagnetic transition at approximately 150 K. Two other transitions were observed at lower temperatures, that might be related to the polymorphism of the SRO crystal structure [3, 4]. Preliminary results of a YBCO(100nm)/SRO(50nm) heterostructure point to an epitaxial sample with good crystal quality and low surface roughness. In comparison to a YBCO(100nm) thin film, the YBCO(100nm)/SRO(50nm) heterostructure shows a reduction of the transition temperature T_c to the superconducting phase, which can be related to proximity effects. The latter results will be further examined, and other characterizations will be performed to investigate the presence of proximity effects on YBCO/SRO heterostructures.

References

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