



Beitrag ID: 99

Typ: Talk

Magnetic and Transport Signatures of Strain in SrRuO₃ Thin Films: Insights from STO and Si-Based Substrates

Dienstag, 7. Oktober 2025 17:00 (15 Minuten)

SrRuO₃ (SRO), a widely studied ferromagnetic metallic perovskite oxide, exhibits perpendicular magnetic anisotropy (PMA) when subjected to appropriate strain conditions. Its excellent lattice matching with SrTiO₃ (STO) enables nearly perfect epitaxial growth, making it an ideal platform for investigating strain-induced effects in functional oxide systems [1]. Although strain-tuned ferromagnetism has been examined in several perovskite heterostructures, the influence of strain on the magnetic anisotropy and transport behavior of SRO remains an ongoing research focus. The anomalous Hall effect (AHE) in SRO displays non-traditional characteristics that are highly sensitive to strain, film thickness, and elemental doping, warranting further studies on how epitaxial strain modulates its electronic and magnetic responses. To delve deeper into these phenomena, ~20 nm SRO thin films were fabricated using high oxygen pressure sputtering (HOPS) on TiO₂-terminated STO (001) single crystals and on STO-buffered (4 nm) Si (001) substrates, under identical deposition conditions. X-ray diffraction (XRD) confirmed epitaxial growth, and X-ray reflectivity (XRR) provided precise information of film thickness and interfacial roughness. Magnetization studies indicated a Curie temperature (T_c) of 155 K for both film types but revealed contrasting magnetic anisotropies. The SRO/STO film demonstrated a stronger out-of-plane magnetic component, whereas the SRO/STO/Si film favored in-plane magnetization. This directional dependence was further reflected in magnetoresistance (MR%) measurements, which peaked when the magnetic field aligns with each sample's easy axis. Notably, AHE results for the SRO/STO/Si film showed an anomalous peak, potentially arising from Ru-site vacancies [2], implying the coexistence of multiple magnetic contributions within the film. These results highlight the pivotal influence of epitaxial strain in controlling both the magnetic orientation and electronic transport properties in SRO-based heterostructures. To further unravel the role of the STO buffer layer in modulating interfacial magnetism, we plan to conduct detailed polarized neutron reflectometry (PNR) measurements on SRO films grown on STO-buffered Si and single-crystal STO substrates. These experiments, scheduled for October 2025 at the Spallation Neutron Source (SNS), ORNL, USA, will offer deeper insights into strain-driven magnetic phenomena at the atomic scale in complex oxide systems.

Autor: SINGH, Ankita

Co-Autoren: BEDNARSKI-MEINKE, Connie (JCNS-2); KENTZINGER, Emmanuel (Forschungszentrum Jülich GmbH, Jülich Centre for Neutron Science); DE OLIVEIRA LIMA, Vitor Alexandre (JCNS-2)

Vortragende(r): SINGH, Ankita

Sitzung Einordnung: Emergent phenomena in functional and nano-magnets

Track Klassifizierung: Emergent phenomena in functional and nano-magnets