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Transitions in Fe3O4/Nb:STO heterostructures investigated by Polarized Neutron Reflectometry

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The Fe_3O_4/Nb:STO system has garnered significant attention due to its potential applications in spintronics and memristors. We present an investigation of a 30 nm Fe_3O_4 thin film deposited on a Nb-doped $SrTiO_3$ (Nb:STO) substrate using Polarized Neutron Reflectometry (PNR) and X-ray Reflectometry (XRR) at low temperatures. Around 105K, Nb:STO undergoes an antiferrodistortive transition, and the resulting faceting induces extra strain on the Fe_3O_4 films, and also affects the resolution and interpretation of PNR measurements [1]. Fe_3O_4, known for its Verwey transition around 120 K, exhibits changes in electronic conductivity and magnetic properties as the temperature passes through T_V due to structural changes from cubic to monoclinic.

Our study reveals that low temperatures induce notable modifications in the roughness and density of the Fe_3O_4 film, driven by the transitions in both the Nb:STO substrate and the Fe_3O_4 film itself. The Verwey transition in Fe_3O_4 leads to marked changes in its magnetic profile, as observed through variations in the magnetic scattering length density.

These findings highlight the complex interplay between the transitions in Fe_3O_4 and Nb:STO, providing insights for the development of advanced memory and spintronic devices.

[1] Hoppler et al,PRB 78, 134111 (2008)

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Sitzung Einordnung: Mounting Posters, Beer and light Dinner

Track Klassifizierung: Magnetism & Superconductivity