

Resonant Photoemission studies of $\text{Ti}_{1-x}\text{Fe}_x\text{O}_{2-d}$ epitaxial films

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Abstract

We have investigated the structural and electronic properties of the epitaxial thin films of Fe doped (4 at. %) and undoped anatase TiO_{2-d} deposited pulsed laser deposition. The films reveal room temperature magnetic hysteresis behavior. We have examined the electronic environment of Ti and Fe using photoelectron spectroscopy measurements, which reveal the ionic state of Fe in TiO_2 , excluding the possibility of Fe metal clusters. Valence band spectra of these films mainly involve O-2p derived state. In Fe doped film, Fe derived state is also observed. Resonance photoelectron spectroscopy studies indicate that Fe ions are hybridized with the oxygen vacancy induced Ti 3p defect states. Our study reveals the formation of local magnetic moment and finite density of states at the Fermi level indicating its metallic (degenerate semiconducting) behavior in both the films, leading to magnetic ordering at room temperature and a Kondo minimum in resistivity behavior. Present work suggests that there is a competition between magnetic ordering mechanism by J_{RKKY} and moment screening mechanism by J_{Kondo} .

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