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Magnetic properties and compositional homogeneity in (Ce,La,Sr)(Ti,Fe)O_3 films

XUEYIN SUN, PENG JIANG, Harbin Institute of Technology and Massachusetts Institute of Technology, LEI BI, DONG HUN KIM, Massachusetts Institute of Technology, DAMING JIANG, GAOHUI WU, Harbin Institute of Technology, G.F. DIONNE, C.A. ROSS, Massachusetts Institute of Technology — Single crystal films of $Sr(Ti_{1-x}Fe_x)O_3$ are magnetic well above room temperature with up to 0.8 μ_B/Fe and exhibit strong out-of-plane magnetoelastic anisotropy. The properties are governed by the Fe valence states which can be manipulated by substitution on the A-site. Here, ∼150 nm thick films of $(A_ySr_{1-y})(Ti_{0.6}Fe_{0.4})O_3$ where A=La or Ce were grown on $(LaAlO_3)_{0.3}(Sr_2AlTaO_6)_{0.7}$ substrates by pulsed laser deposition. The La and Ce raised the saturation moment but lowered the optical transparency as the average Fe valence decreased. Theoptical band gap widened and the Fermi level moved toward the vacuum level with increased Ce or La content. The composition distribution in a film with 30% Ce was analyzed by high angle annular dark-field scanning transmission electron microscopy (HAADF-STEM).The film showed columnar growth with homogeneous distribution of Ce, Fe, Ti and O, precluding the possibility of clustering or phase separation.

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