Thermomagnetic Properties of Mixed-Valence $La_{1-x}Sr_xMnO_3$ Manganite Films near the x ≈ 0.2 Phase Transition

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Among the mechanisms enabling spin-current generation, the longitudinal spin Seebeck effect (LSSE), driven by an out of plane thermal gradient, represents a key phenomenon for the recently growing field of spin-tronic and spin-caloritronic applications [1], allowing the direct conversion of waste heat into spin and electrical signals. In this work, we investigate the LSSE response in epitaxial $La_{1-x}Sr_xMnO_3$ thin films with x ≈ 0.2., due to its proximity to the ferromagnetic insulating Pnma – metallic R3c phase boundary, where enhanced magnetic, electronic and thermomagnetic responses are expected. Mixed valence LSMO manganites are known for presenting phenomena such as Giant Magnetoresistante (GMR)[2] and Magnetocaloric Effect (MCE). The variety of phases and effects arises from their strong coupling between lattice, charge, orbital, and spin degrees of freedom.

An epitaxial thin film was grown by pulsed laser deposition (PLD) on $SrTiO_3$ (STO) substrate and the LSSE voltage was measured by swiping the in-plane external magnetic field. The observed nontrivial temperature dependence of the thermoelectric signal strongly suggests a dominant magnon-mediated thermal transport mechanism. Complementary first-principles density functional theory (DFT) calculations within the PAW method, as implemented in VASP [3,4] were done to investigate the evolution of the structural, electronic and magnetic properties for different Sr concentrations, both below and above x = 0.2.

Referencias

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