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Magnetic and transport properties of twinned $La_{0.65}Ca_{0.35}MnO_3$ films

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$La_{0.65}Ca_{0.35}MnO_3$ films on twinned $LaAlO_3$ substrates were prepared by rf-magnetron sputtering. Since the twin structure of the $LaAlO_3$ substrate serves as a template for the thin-film growth, a mixture of ferromagnetic metallic (FMM) and charge-ordered insulating (COI) phases can be formed with a nonuniform distribution of the lattice strain [1]. The magnetic and the transport properties of twinned $La_{0.65}Ca_{0.35}MnO_3$ films were investigated in order to clarify the coexistence of COI and FMM phases. The films really exhibit a mixed FMM and COI phase because of a nonuniform distribution of lattice strain. It is shown that a decrease in transport current leads to formation of the COI state in the temperature range below the metal-insulator transition (MIT). A thermal cycling of the film induces the formation of a nonequilibrium state in the ensemble of COI domains and the appearance of a giant resistance switching up to 100%. According to Podzorov et al. [2], an increase of the resistance in manganese oxides with a charge ordering is governed by the charge-disordered insulating (CDI) phase, stabilized at low temperatures owing to a martensitic nature of the COI domains and to an accommodating strain which is introduced into the surrounding lattices at the MIT. We argue that the synergy between a martensitic nature of the charge ordering and the local current gives rise to this effect.

[References]

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