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Signatures of electronic phase separation in the Hall effect of anisotropically-strained $La_{0.67}Ca_{0.33}MnO_3$ films with a magnetically driven percolative phase transition LIUQI YU, XIAOHANG ZHANG, S. VON MOLNÁR, P. XIONG, Florida State University, LINGFEI WANG, W.B. WU, USTC, China — Hall measurements have been performed on $La_{0.67}Ca_{0.33}MnO_3$ (LCMO) films with varying degrees of anisotropic strain. The strain is induced by epitaxial growth on $NdGaO_3$ substrate and controlled via post annealing. An antiferromagnetic insulating (AFI) state emerges upon annealing at low temperatures.[1] The Hall effect (HE) data exhibit many unusual features that are indicative of a magnetically driven percolation. In the paramagnetic phase, it is found the Hall resistivity shows a distinct slope change at a constant critical magnetization over the temperature range, which is interpreted as a critical point of a magnetic field driven percolative phase transition. At lower temperatures near the metal-insulator transition, a negative Hall resistivity peak emerges. This Hall resistivity dip correlates with the emergence and strengthening of the AFI state, and is suppressed with the melting of the AFI state by an in-plane field. The Hall resistivity dips in LCMO resemble the giant HE in granular metal films near the composition-driven percolation,[2] which is interpreted as a result of the enhancement of Hall coefficient beyond the percolation point. The observations reveal an important manifestation of the magnetic field driven percolative phase transition in the HE of LCMO with an insulating background. Work supported in part by NSF DMR-0908625 and DMR-1308613.

[1]Z. Huang et al., JAP 105, 113919(2009)
[2]X. X. Zhang et al., PRL 86, 5562 (2001)

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