MAR11-2010-001153

Abstract for an Invited Paper
for the MAR11 Meeting of
the American Physical Society

Mesoscopic orientation-ordered percolating network in a strained manganite thin film

KEJI LAI, Stanford University

Many unusual behaviors in complex oxides are deeply associated with the spontaneous emergence of microscopic phase separation. Recent studies on these strongly correlated materials have shown that multiple states can coexist near certain phase boundaries. In this work, a cryogenic microwave impedance microscope [1] is implemented to investigate the microscopic origin of the colossal magnetoresistance effect in manganite thin films. In a strained $Nd_{0.5}Sr_{0.5}MnO_3$ thin film grown on (110) $SrTiO_3$ surface, the filamentary ferromagnetic metallic domains emergent from the antiferromagnetic charge/orbital-ordered insulating background as increasing magnetic fields align preferentially along certain crystal axes of the substrate [2]. Such an orientation ordering is missing in a relaxed sample with partial loss of the epitaxial coherency. The mesoscopic glassy orders with a period of 100nm indicate that the substrate-induced anisotropic strain rather than the Coulomb interaction plays the dominant role in the phase separation. The microwave images also revealed drastically different domain structures between the zero-field-cool and field-cool processes, consistent with the macroscopic transport measurements in both bulk and thin film materials.

[1] W. Kundhikanjana *et al.*, arXiv 1010.1509.
[2] K. Lai *et al.*, *Science* **329**, 190 (2010).