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Figure S1. Schematic diagrams showing different film growth modes: (a) multilayer growth mode and (b) columnar growth mode.



Figure S2. (a) Magnetic hysteresis loops with a cooling field of 2000 Oe down to 10 K of the pure LSMO film. (b) The enlarged regimes near the original point.



Figure S3. The θ -2 θ XRD patterns of the LSMO:NiO composite film with the columnar structure.



Figure S4. (a) Temperature dependence of zero field cooling (ZFC) and field cooling (FC) for the pure LSMO film and the composite films. (b) The differentiation of the magnetization versus temperature.



Figure S5. Coercive field of the composite film with (a) the multilayer structure and (b) the columnar structure as a function of temperature extracted from the magnetic hysteresis loops after in-plane field cooling.