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Fabrication, characterization, and magnetic and electronic properties of epitaxial $La_{0.5}Sr_{0.5}CoO_3$ films M.A. TORIJA, M. SHARMA, J. WU, C. LEIGHTON, University of Minnesota — Bulk $La_{1-x}Sr_xCoO_3$ (LSCO) has received considerable attention with regard to magnetic phase separation. Fabrication of epitaxial films would provide a means to study this phase separation under dimensional confinement. We have investigated the properties of epitaxial films of x = 0.5 LSCO on $SrTiO_3$ (001) by reactive d.c. sputtering from compound targets. Structure and properties were studied as a function of sputtering pressure, O_2/Ar ratio, and post-deposition O_2 treatment. Optimized conditions result in single phase, stoichiometric, substantially relaxed, epitaxial films. At a fixed O_2 / Ar ratio, two distinct regimes of total sputtering pressure (P) occur. Films grown at $P > 50$ mTorr have properties close to bulk; they are ferromagnetic ($T_C \approx 230$ K, $M_S \approx 2\ \mu_B$ / Co), have a metallic-like $\rho(T)$ at all T, and exhibit 10 % magnetoresistance at T_C. For $P < 50$ mTorr, we obtain lower surface roughness and narrower rocking curves but with low moment, insulating $\rho(T)$, and increased out-of-plane lattice parameter due to O deficiency. Similarly, a dramatic enhancement in physical properties, and elimination of a CoO minority phase, is obtained when cooling in 500 Torr of O_2. The results demonstrate good control over the oxygen stoichiometry, and therefore physical properties. Work supported by NSF DMR.

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