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Magnetic properties of La–Sr–Mn–O/Si thin film as a function of RF magnetron power and O_2 partial pressure

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Abstract

Polycrystalline perovskite compound sputtering target $La_{0.67}Sr_{0.33}MnO_3$ has been prepared by a conventional ceramic method. La–Sr–Mn–O/Si thin films have been produced under various applied RF sputtering power and oxygen partial pressure at 700°C. Deposited thin films were annealed for 1 h at 800°C in O_2 atmosphere. Structures, magnetic properties and compositions of the La–Sr–Mn–O films have been studied with X-ray diffraction, Rutherford back-scattering spectroscopy (RBS), atomic force microscopy, scanning electron microscopy and vibrating sample magnetometer. Crystalline La–Sr–Mn–O thin films was perovskite monoclinic. In the case of RF-power 2.46 W/cm^2 and $P_{O_2} = 20\%$, $La_{0.85}Sr_{0.15}MnO_3$ films have lattice parameters $a_0 = 5.489$ Å, $b_0 = 5.517$ Å, $c_0 = 7.769$ Å and $\beta = 89.07°$. The thickness of $La_{0.85}Sr_{0.15}MnO_3$ film was found to be 900 ± 50 Å by α-step and RBS measurement. The coercive force and the saturation magnetization of the $La_{0.85}Sr_{0.15}MnO_3$ film at room temperature was $H_{C\|} = 5$ Oe and $M_{S\|} = 235$ emu/cm^2 with applied field 5 kOe. The temperature dependence of the resistance under zero and 15 kOe applied fields shows that a semiconductor–metal transition, T_{SC-M}, occurs at 240 K. The relative magnetoresistance, MR, is about 9.6%.

Keywords: Perovskite compound; RF sputtering; RBS; Magnetoresistance