

Fabrication of $\text{La}_{1-x}\text{Sr}_x\text{MnO}_3$ Thin Films by Chemical Solution Deposition for High Temperature Resistive Materials

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$\text{La}_{1-x}\text{Sr}_x\text{MnO}_3$ (LSMO) films have prominent electrical properties; that is, the temperature coefficient of resistance (TCR) is considerably higher than that of VO_x films at small substitution of Sr for La such as $x = 0.2$ - 0.3 , which is suitable for uncooled bolometric detectors.¹⁾ Meanwhile, at larger substitution of Sr for La ($x \geq 0.5$), the TCR of the films tends to have decreased above room temperature. Coupled with its relatively low electrical resistivity and stability at high temperatures as oxide materials, LSMO will be a promising candidate for high temperature resistive materials. Therefore, in this study, we have fabricated epitaxial LSMO thin films by chemical solution deposition (CSD) onto SrTiO_3 (STO) substrates and measured electrical properties of the films systematically to find an optimum composition that can minimize the TCR. Amorphous LSMO thin films with $x = 0.5$ - 0.9 were fabricated by CSD. The precursor solutions used for fabricating the LSMO films contained premixed 2-ethylhexanoate solutions of La, Sr, and Mn diluted with toluene. A series of solutions with $x = 0.5$ - 0.9 was spin-coated onto single crystalline STO(100) substrates at 4000 rpm (revolutions per minute) for 10 s. The coated films were dried at 100 °C in air to remove the solvent, and then preheated at 500 °C in air for 10 min to decompose the organic residues in the films. This procedure was repeated three times to increase the film thickness. The preheated films were fired at 1000 °C for 2 h. The electrical resistivity of the films was measured by the van der Pauw method. Figure 1 shows temperature dependence of the electrical resistivity ρ of LSMO thin films on STO substrates. The LSMO films show a transition from a metallic behavior to a semiconducting behavior at $x = 0.6$ - 0.7 . This result indicates that the minimum TCR above room temperature can be obtained in the vicinity of $x = 0.6$ - 0.7 .

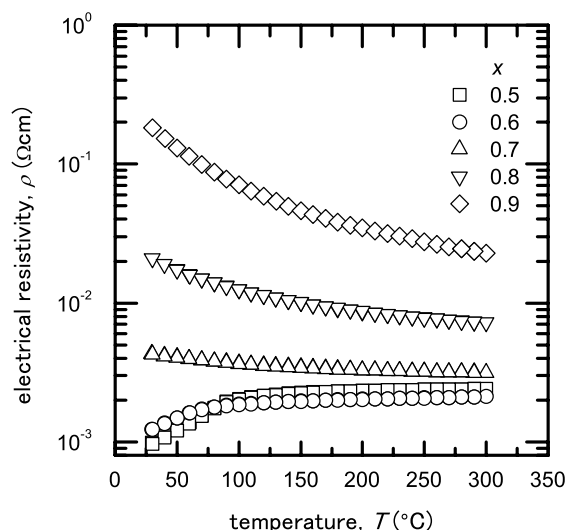


Fig. 1: The electrical resistivity of $\text{La}_{1-x}\text{Sr}_x\text{MnO}_3$ thin films fabricated onto SrTiO_3 (100) single crystal substrates by a chemical solution deposition method.

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References: 1) Tsuchiya *et al.*, Appl. Surf. Sci. **255** (2009) 9804.