Characteristics of $La_{0.75}Ca_{0.25}MnO_3$ Films Grown on Si(100) Substrates

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ABSTRACT

We grew $La_{0.75}Ca_{0.25}MnO_3$ (LCMO) films with different thicknesses on Si(100) substrates using RF magnetro sputtering. We used the X-ray diffractiometer and a closed-cycle cryocooler system to measure crystalline structure and restistance of films, respectively. In this work, we study the strain and oxygen-annealing effects on the temperature coefficient resistance (TCR) and metal-insulator transition temperature (Tp) for films with different thicknesses. We found that the Tp, maximum TCR value (TCRmax), and magnetoresistance (MR) are increased for films with thicknesses. We also found that the TCRmax and MR are decreased for films with oxygen annealing. For the 1200-A-thick films, the achieved values of Tp, TCRmax, and MR are 181 K, 1.93 %K-1, and 38 %, respectively. Finally, the relationship between TCRmax and bipolaron binding energy, λ1 is deduced by the current-carrier-density-collapse model. It is observed that the TCRmax increases as λ1 is decreased, being in agreemeat with the theoretical prediction.

Keywords : strain effect ; RF sputtering ; temperature coefficient of restistance

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