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Large room temperature magnetoresistance in $La_{0.9}Sr_{0.1}MnO_3$ thin films

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Abstract

Epitaxial $La_{0.9}Sr_{0.1}MnO_3$ thin films were crystallized using post-annealing after deposited at room temperature, and the effect of sputtering pressure on the structural, magnetic and electrical properties was investigated. It is interesting to note that the out-of-plane lattice parameter decreases with decreasing sputtering pressure, which is attributed to the reduction of Mn^{3+}/Mn^{4+} ratio. Differing from the corresponding bulk material, all the films show metal-insulator (MI) transition with a significantly enhanced Curie temperature (T_C). And the film deposited at 1.0 Pa shows the maximum T_{MI} and T_C resulted from the strongest double exchange interaction. Most significantly, the largest magnetoresistance around room temperature (-53% at 3T and 295 K) is also observed in this film, showing great potential in application.

Key words: $La_{0.9}Sr_{0.1}MnO_3$ thin films, sputtering pressure, oxygen content, magnetoresistance

1. Introduction

Doped perovskite manganites $L_{1-x}B_xMnO_3$ (L is a trivalent rare-earth ion and B is a divalent alkali-earth ion) have attracted widespread attention due to their distinctive magnetic and electronic behaviors such as colossal magnetoresistance (CMR) [1] and spin-polarized character [2], which make them promising for applications in magnetic random access memories, magnetic sensors, and various spintronic devices [3]. As the doping level x varies, the compound $L_{1-x}B_xMnO_3$ exhibits a rich variety of electronic, magnetic, and structural phase transitions at different temperatures, such as

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