2003 SOMMA/KMS meeting
International Symposium on Magnetic Materials and Applications and
Winter Conference of the Korean Magnetics Society

December 3–6, 2003, Spapia Hotel, Daejeon, Korea

Organized by
Research Center for Advanced Magnetic Materials
The Korean Magnetics Society

Sponsored by
Chungnam National University
The Korea Science and Engineering Foundation
The Ministry of Science and Technology
The Korean Federation of Science and Technology Societies

Research Center for Advanced Magnetic Materials
The Korean Magnetics Society
Magnetoresistance and surface properties with deposition condition for the La-Sr-Mn-O thin films

Geun Young Ahn, Seung-iel Park, In-Bo Shim, Young Suk Cho and Chul Sung Kim*
Department of Physics, Kookmin University, Seoul 136-702, Korea
*Corresponding author: e-mail: cskim@phys.kookmin.ac.kr, Phone: +82 2 910 4752, Fax: +82 2 910 4728

Polycrystalline La-Sr-Mn-O (LSMO) thin films were deposited on Si (100) substrate by the RF magnetron sputtering. The deposition condition of the LSMO thin films was 0, 20, 40, 60 and 80 % partial oxygen pressures of the buffer gas. The deposition RF power and the substrate temperature have 2.46 W/cm² and room temperature. All deposited films were annealed at 800 °C for 3 hour in ambient. The crystalline structure, the chemical composition, surface characters and the magnetic properties of the LSMO films were studied using a x-ray diffraction, an oxygen back-scattering spectroscopy, a x-ray photoemission spectroscopy, an atomic force microscopy, a scanning electron microscopy and a vibrating sample magnetometer. The crystalline structure of the all LSMO thin films was found to be a perovskite cubic structure with the lattice parameter \( a_0 = 3.862 \pm 0.001 \) Å at room temperature. The lattice parameter of the LSMO films has no significant change as oxygen partial pressure increased, whereas the root mean square roughness (\( R_{\text{rms}} \)) and particle size decreased. Figure 1 show the AFM image of the LSMO film with \( P_{O_2} = 60 \) %. The chemical composition of the LSMO film with \( P_{O_2} = 60 \) % was determined to be La\(_{6.60}\)Sr\(_{0.32}\)MnO\(_{3.2}\) with the XPS spectrum analysis. In this case of the tunnelling low-field MR has a maximum value of 0.68 % under the applied field of 500 Oe at room temperature as shown in Fig.2. The enhancement of the low-field MR ratio is caused by the improvement of morphologies, the growth of uniform and smaller grains according to the increased partial oxygen pressure in LSMO films. The correlation between the grain size and the tunnelling magnetoresistance at room temperature can be explained that the grain boundary regions can play the role of a potential barrier.

Fig.1. The AFM Image of the LSMO film with \( P_{O_2} = 60 \) % at room temperature.

Fig.2. The tunnelling magnetoresistance of the LSMO film with \( P_{O_2} = 60 \) % under the applied field of 500 Oe at room temperature.