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LOW-FIELD TUNNEL-TYPE MAGNETORESISTANCE PROPERTIES OF La-Pb-Mn-O THIN FILMS

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The low-field tunnel-type magnetoresistance (TMR) properties of sol-gel derived polycrystalline and hetero-epitaxial La-Pb-Mn-O (LPMO) thin films were investigated. Polycrystalline thin films were fabricated on yttria stabilized zirconia (YSZ) layer, while hetero-epitaxial thin films were grown on LaAlO₃(001)(LAO) single crystal substrate and then annealed at an elevated temperature for 3 hours in air. The full-width-half-maximum (FWHM) of the rocking curve for LPMO/LAO thin film was 0.479°, which indicated a good crystalline structure. X-ray diffraction analysis showed that the structures of LPMO/LAO and LPMO/YSZ films were orthorhombic with the lattice parameters of $a_0 = 5.5094 \text{ \AA}$, $b_0 = 5.4860 \text{ \AA}$, $c_0 = 7.7626 \text{ \AA}$ and $a_0 = 5.5071 \text{ \AA}$, $b_0 = 5.4852 \text{ \AA}$, $c_0 = 7.7371 \text{ \AA}$, respectively. The surface roughness in the thin film LPMO/LAO was 105.0 Å and in the film LPMO/YSZ was 138.7 Å from the atomic force microscopes (AFM). Tunnel-type MR ratio as high as 0.67% was observed in polycrystalline thin films under the applied field with 500 Oe at room temperature (300 K), whereas the hetero-epitaxial films was less than 0.48% in the same field range. Well-pronounced low-field magnetoresistance hysteresis was registered with an MR peak in the vicinity of the coercive field. The low-field tunnel-type MR characteristics of thin films deposited on different substrates originated from the behavior of grain boundary properties.

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