THE INFLUENCE OF GROWTH RATE AND SUBSTRATES' THERMAL EXPANSION COEFFICIENT ON PROPERTIES OF NANOCRYSTALLINE La-Sr-Mn-Co-O FILMS

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Thin polycrystalline manganite-cobaltite (LSMCO) films are interesting for their magnetoresistive (MR) properties and current application as room temperature B-scalar magnetic field sensors. Further research activities were performed in order to enable application of nanostructured LSMCO films in weak magnetic field sensing. In previous research it was determined the dependence of MR and electrical properties on Co content and on intrinsic tensile strain in the LSMCO films [1]. On the other hand, the tensile strain is largely influenced by the thermal expansion coefficient of the used substrates and the thin film growth rate [2].

In the present research the strain influence on the properties of nanostructured LSMCO films is investigated. Therefore, pulsed-injection metalorganic chemical vapor deposition (PI-MOCVD) method was used for the deposition of nanostructured $La_{0,81}Sr_{0,19}Mn_{1,09}Co_{0,06}O_3$ on substrates with different thermal expansions coefficients: polycrystalline Al_2O_3 (7.6 x 10^{-6} K^{-1}), x-cut $LiTaO_3$ (LTO_x) (16.1 x 10^{-6} / K^{-1}) and Zerodur® (0.5 x 10^{-6} / K^{-1}). Furthermore, the growth rate influence was investigated by growing 400 nm thick LSMCO films at different deposition rates at the growth temperature of 600 °C.

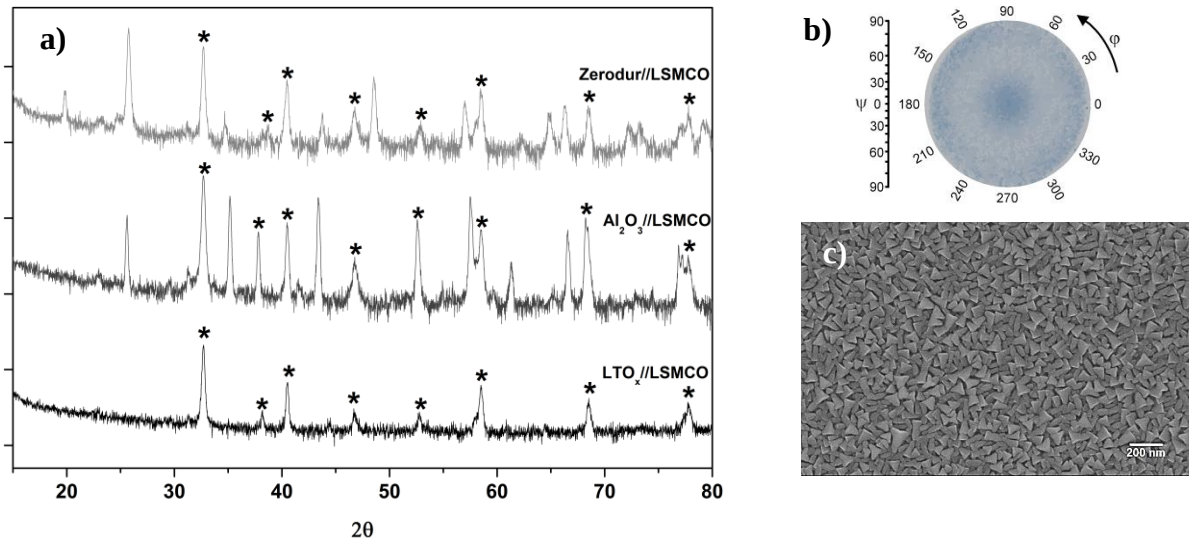

Fig 1. a) Grazing incidence diffractograms of LSMCO thin films grown on different substrates, where stars indicate characteristic reflection peaks of LSMCO; b) Characteristic (111) pole figure of polycrystalline LSMCO on Al_2O_3 substrate; c) Characteristic scanning electron microscope (SEM) image of nanostructured LSMCO films.

Despite the difference in thermal expansion coefficients of the substrates, all grown LSMCO films were polycrystalline (Fig. 1a). The characteristic (111) pole figure (Fig. 1b) as well as SEM images (Fig. 1c) confirmed the nanostructured behavior of LSMCO films with the average grain size below 100 nm.

[1] Vagner, M., et al. (2020). "PI-MOCVD technology of (La, Sr)(Mn, Co)O3: From epitaxial to nanostructured films." Surface and Coatings Technology **385**: 125287.
[2] G. Abadias, et al. (2018). "Review article: Stress in thin films and coatings: Current status, challenges, and prospects". J. Vac. Sci. Technol. A **36**: 020801.