OBSERVATION OF THE CHARGE-ORDERED STATE IN A HETEROGENEOUS $La_{0.7}Ca_{0.3}MnO_{3-\delta}$ THIN FILM WITH OXYGEN DEFICIENCY

V. G. Prokhorov[a], Y. P. Lee[b], V. A. Komashko[a], V. Svechnikov[a], J. S. Park[b], and K. W. Kim[c]

[a]Institute of Metal Physics, NASU, Kiev, 03142, Ukraine
[b]Department of Physics, Hanyang University, Seoul, 133-791 Korea
[c]Department of Physics, Sunmoon University, Choongnam, 336-840 Korea

9.7 cm

The magnetic and transport investigations were carried out for the oxygen-deficit $La_{0.7}Ca_{0.3}MnO_{3-\delta}$ films ($\delta \simeq 0.1$) with different thickness. The x-ray diffraction and high-resolution electron microscopy data showed that a growth in the film thickness leads to a structural transition from the lattice-strained cubic (with out-of-plane lattice parameter $c \simeq 0.379$ nm) to the relaxed rhombohedral phase ($c \simeq 0.395$ nm). The evidence for the charge-ordered insulating (COI) state was observed for the compressed cubic phase which is formed in the thin (d $\simeq$ 30 nm) film owing to the epitaxial growth and to a large mismatch in the lattice parameter between substrate ($LaAlO_3$) and film. The applied magnetic field (5T) melts the COI state and leads to the transition of thin film in the ferromagnetic metal-like state. The magnetic data showed that the Curie point is shifted from $\simeq$ 80 K for rhombohedral phase to $\simeq$ 210 K for cubic one. It was claimed that formation of the COI state and shift of Curie point are governed by a compression of the crystal lattice rather than the accumulation of the oxygen vacancies.

13.4 cm

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Corresponding author :
V. G. Prokhorov

Address for correspondence :
Institute of Metal Physics, NASU, 36 Vernadsky Blvd., 03142 Kiev, Ukraine

Email address :
pvg@imp.kiev.ua