Effect of Sr substitution in La-Ca-Mn-O compound on structural and electrical properties

ABSTRACT

Polycrystalline manganites compound of $La_{0.67}A_{0.33}MnO_3$ (A= Sr, Ca) has prepared by conventional solid state reaction method. In this work, an effort has been made to study the influences of substitution with different alkaline earth in La-site. The structural of $La_{0.67}A_{0.33}MnO_3$ was studied by X-ray diffraction patterns (XRD), XRD spectrums of $La_{0.67}Ca_{0.33}MnO_3$ (LCMO) showed in orthorhombic structure (space group *Pbnm*) while $La_{0.67}Sr_{0.33}MnO_3$ (LSMO) was in hexagonal structure (R-2c). The LCMO and LSMO bulks were investigated magnetically in view to understanding the ferromagnetic-paramagnetic (FM-PM) behaviors using vibrating sample magnetometer (VSM) at room temperature. LSMO bulk sample exhibited ferromagnetic with high in magnetization while LCMO bulk was in paramagnetic behaviors. The Curie temperature and metal-insulator transition temperature (T_p) were measured using AC Susceptibility (ACS) at temperature range 78 K-300 K and four-point probe technique. The T_c for LCMO was 260 K, the curves coincide at temperatures above 240 K and become zero around the Curie critical temperature, where the FM-PM transition occurs and T_p for LCMO was reported around 250 K. Meanwhile, the T_c and T_p for LSMO were above 300 K. The difference in grain sizes of the microstructure images of LCMO and LSMO are might be due to the substitution of variance alkaline earth ions that differs in grain growth were observed using scanning electron microscopy (SEM). By replacing Sr^{2+} in La-Ca-MnO, the crystal structure transform from orthorhombic to hexagonal with highly symmetrical, thus the MnO_6 octahedral are less distortion and the local spins are relatively more aligned. Therefore, electron hopping interaction at sub-orbital ($3d:e_g$) increase, resulting the T_c and T_p are shifted to higher values.

Keyword: Bulks; Electrical properties; Magnetic materials; Perovskite manganites; Structural