Structure, microstructure and magnetic properties study of ceramic composite $(La_{0.67}Ca_{0.33}MnO_3)_{1-x}/(Nano\text{-}sized\alpha\text{-}Fe_2O_3)_x$

ABSTRACT

The structural, microstructure and magnetic properties of polycrystalline $(La_{0.67}Ca_{0.33}MnO_3)_{1-x}/(\alpha\text{-}Fe_2O_3)_x$ composites where x = 0%, 5%, 10%, 15%, 20% were investigated. Polycrystalline $La_{0.67}Ca_{0.33}MnO_3$ (LCMO) was synthesized via solid state reaction at high sintering temperature while for nano-sized Fe_2O_3 (20-50 nm) a commercial product was used. X-ray diffraction (XRD) patterns show that parent compound of $La_{0.67}Ca_{0.33}MnO_3$ is a single phase without any detectable impurity and give orthorhombic structure with space group Pbnm (62) while α- Fe_2O_3 is in cubic form with space group I a -3 (206). As Fe_2O_3 content x increases, the magnetization M values decrease as observed via Vibrating Sample Magnetometer (VSM) at room temperature. Higher magnetization is noticed inpure LCMO rather than in LCMO composites added with α- Fe_2O_3. However, Scanning Electron Microscopy (SEM) shows that nano-sized Fe_2O_3 mainly distributed at the grain boundary of $La_{0.67}Ca_{0.33}MnO_3$. The particle size of LCMO composites shows fluctuation; meanwhile particle size of α- Fe_2O_3 shows almost similar values except for sample with the addition of 15% of α- Fe_2O_3 where lowest particle size with higher coercivity and retentivity are observed. As compared to pure La0.67Ca0.33MnO3, Fe_2O_3 doping level at the grain boundaries can be assumed to modify the magnetic properties of $La_{0.67}Ca_{0.33}MnO_3$.

Keyword: Bulks; Structura; Grain boundaries; Magnetic materials; Perovskite manganites