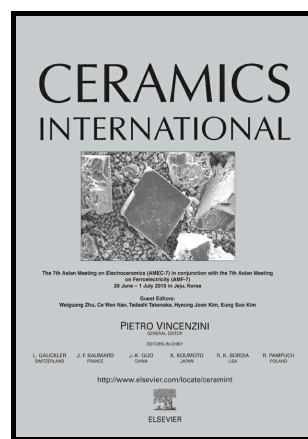


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Critical behavior near the paramagnetic to ferromagnetic phase transition temperature in $\text{La}_{0.6}\text{Sr}_{0.4}\text{MnO}_3$ ceramic: A comparison between sol-gel and solid state process

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Abstract

Critical behavior near the paramagnetic (PM) to ferromagnetic (FM) phase transition in $\text{La}_{0.6}\text{Sr}_{0.4}\text{MnO}_3$ ceramics prepared by sol-gel and solid state reaction methods has been systematically investigated. The XRD result coupled with the structural Rietveld refinement method exhibited that all samples crystallized in a rhombohedral structure with a space group of R-3C, which indicated the formation of the perovskite structure of $\text{La}_{0.6}\text{Sr}_{0.4}\text{MnO}_3$. The magnetic data obtained from magnetization measurements indicated a second-order phase transition from PM-FM phase around Curie temperature (T_C). Critical exponents, β , γ , and δ values are estimated by various theoretical models such as the modified Arrott plot (MAP), the Kouvel-Fisher plot (KF) and the critical isotherm (CI) techniques. Grain size dependence of the critical behavior of $\text{La}_{0.6}\text{Sr}_{0.4}\text{MnO}_3$ samples with different sizes from nano-scale to mic-scale was detected by fitting the experimental data to the theoretical models.

Keywords: Ceramic, Manganite, Size effect, Critical exponents.

1. Introduction

In the past decades, perovskite-type $\text{La}_{1-x}\text{Sr}_x\text{MnO}_3$ (LSMO) ceramics have been regarded as one of the most attractive compounds because of their metallic nature, large bandwidth, and magnetic phase transition around the room temperature ($T_C = 300\text{--}370$ K), in the range of $x \approx 0.17 - 0.5$

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