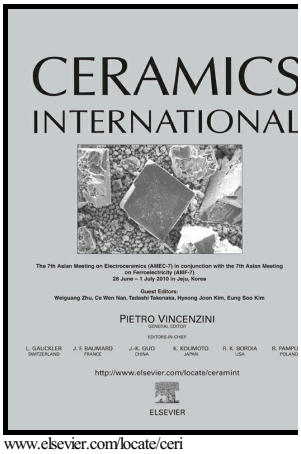

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Magnetic and magnetocaloric properties of nanocrystalline $La_{0.5}Sr_{0.5}MnO_3$

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Abstract

In this paper, we reported a detailed study of magnetic properties and magnetic entropy change of nanocrystalline $La_{0.5}Sr_{0.5}MnO_3$. A rigorous measurement of dc magnetization and isothermal magnetization confirm the presence of paramagnetic-ferromagnetic phase transition at 340 K and the formation of spontaneous magnetization in $T<T_C$ regime. We found that the obtained magnetic entropy change strongly decreases on reduction of samples size down to nanoscale due to the change of magnetostructural phase transition and magnetic homogeneity. Therefore, the magnetocaloric effect is inevitably tuned by the reduction of particle size. The magnetic phase transition observed in this sample was testified to be second-order by the critical exponent analysis and the systemical magnetic interaction could be understood with mean-field theory. Based on the values of magnetic entropy change under different magnetic fields, we can estimate the spontaneous magnetization which shows an excellent agreement with that deduced from the Arrott curves, indicating that the method to determine spontaneous magnetization with a mean-field analysis of the magnetic entropy change is valid for the material with second order phase transitions.

keywords: Magnetism, Magnetic phase transition, Magnetocaloric effect, Magnetic material.

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