Journal of Alloys and Compounds 555 (2013) 33–38

Contents lists available at SciVerse ScienceDirect

Journal of Alloys and Compounds

journal homepage: www.elsevier.com/locate/jalcom

# Ideal Ericsson cycle magnetocaloric effect in $(La_{0.9}Gd_{0.1})_{0.67}Sr_{0.33}MnO_3$ single crystalline nanoparticles

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ARTICLE INFO

*Article history:*
Received 18 April 2012
Received in revised form 6 December 2012
Accepted 7 December 2012
Available online 13 December 2012

*Keywords:*
Magnetic refrigeration
Phase transitions
Magnetocaloric effect
Relative cooling power

ABSTRACT

Single crystalline $(La_{0.9}Gd_{0.1})_{0.67}Sr_{0.33}MnO_3$ nanoparticles with the perovskite structure have been synthesized by the microwave-assisted hydrothermal process, following calcining of the nanoflower precursor at 900 °C for 2 h. Microstructure analysis was conducted by X-ray diffraction, and scanning and transmission electron microscopy (SEM, and TEM), as well as by field emission SEM, and high resolution TEM which confirmed the perovskite structure in the nanoparticles. Systematic magnetic measurements have been conducted on the nanoparticles. It was found that the Curie temperature can be tuned and decreased with Gd doping. It was also interesting to find that the magnetic entropy change ($-\Delta S_M$) in the $(La_{0.9}Gd_{0.1})_{0.67}Sr_{0.33}MnO_3$ nanoparticles extends over a very broad temperature range as a result of the Gd doping. The $-\Delta S_M$ has the important feature of remaining almost constant in the temperature range above 60 K, suggesting that this type of nano-material is an ideal Ericsson cycle magnetic refrigerant for applications at room temperature.