Magnetocaloric effect in $La_{0.70}Ag_{0.25}MnO_3$ magnetic nanoparticles

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Experimental study of magnetocaloric effect (MCE) was performed by indirect and direct methods on $La_{0.70}Ag_{0.25}MnO_{3+\delta}$ nanoparticles. The rhombohedral crystal structure (R-3c space group) of nanoparticles was modified by annealing at 800°C in different atmosphere (air, O_2 and Ar). Direct measurements of the adiabatic temperature change ΔT were carried out by a method of modulation [1] in magnetic fields of 1.8 T. In this case an alternating magnetic field is applied to the sample, which, due to the magnetocaloric effect, induces a periodic change in the temperature of the sample. The indirect method based on determination of the magnetic entropy change ΔS from measurements of magnetic isotherms was undertaken in magnetic fields up to 7 T in the same temperature range as a direct measurement of MCE. Heat treatments affects mainly the content of oxygen and number of defects in the crystal structure which both have significant effect on magnetic properties. The Curie temperature T_C increases from 250 K to 319.5 K and to 322.9 K with the content of oxygen. On the other -ΔS at 7 T decreases from 5.82 $Jkg^{-1}K^{-1}$ to 4.35 $Jkg^{-1}K^{-1}$ and to 3.76 $Jkg^{-1}K^{-1}$ with oxygen content. The direct measurement of MCE revealed that the dependence $\Delta T(f)$ is well described by the expression published in [1], the frequency exponent n= 0.49 and $\Delta T_{f=0}$ =0.284 K. The sample demonstrates the stability of the MCE up to 1000 cycles of switching on and off the magnetic field without any signs of degradation. The paper extends results of our study performed on similar type of nanoparticles [2, 3].

References:

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