Coupling Caloric Effects in (x)0.67PNN-0.33PT – (1-x)$La_{0.85}Ag_{0.15}MnO_3$ Ceramic Composites

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In recent years, multiferrois are considered as perspective materials for solid-state refrigerators, due to the coexitising of the magnetocaloric (MCE), electrocaloric (ECE) and elastocaloric (BCE) effects [1-3]. Multiferroics with a two or more caloric effect, called multicalorics and observation in them caloric effects named multicaloric effect [4]. In particular, in multicalorics due to the interaction of the electric and magnetic subsystems increased the caloric effects near the phase transition temperatures. In this regard, recently search for multicalorics with room temperatures of magnetic and ferroelectric transitions.

Thus, the measurements of the indirect MCE were performed on the multiferroic composites consisting of the 0.67$Pb(Ni_{1/3}Nb_{2/3})O_3$–0.33$PbTiO_3$ (0.67PNN-0.33PT) relaxor-type ferroelectric and manganite $La_{0.85}Ag_{0.15}MnO_3$. Both components have the ferroelectric (FE) and magnetic ordering around 315 K (for $La_{0.85}Ag_{0.15}MnO_3$ T_C^{FM}= 310 K and for 0.67PNN-0.33PT Tc^{FE}=320 K). The composites (x)0.67PNN-0.33PT – (1-x)$La_{0.85}Ag_{0.15}MnO_3$ were synthesized by a conventional solid state reaction method [5] by sintering powders of 0.67PNN-0.33PT and $La_{0.85}Ag_{0.15}MnO_3$ at 1413 K, which previously were milled, mixed in different proportions and pressed into pellets. The microstructure of the composite was studied using X-ray powder diffractometer and scanning electronic microscope.

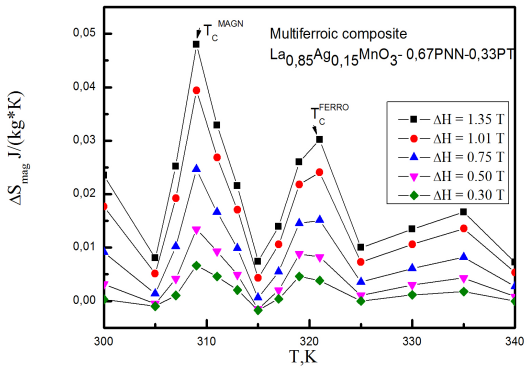

Fig.1. Dependence of entropy change ΔS from temperature for multicaloric composites with x=0.3

As shown from fig 1**.** on the change of entropy vs. temperature dependence were observed double peaks near T_C^{FM}= 310 K and Tc^{FE}=320 K, which confirms the influence of the FE phase on magnetic for sample with concentration x=0,3. If the first peak of ΔS has only magnetic field induced origin, second anomaly of ΔS may be observed due to stress of the FE phase on magnetic component, where FE phase has anomalous increasing of the thermal expansion near 320 K.

References

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