Magnetic relaxations in $La_{0.80}Ag_{0.15}MnO_{3+\delta}$ nanoparticles

M. Zentková,[1] M. Mihalik jr.,[1] M. Kovalik,[1] M. Mihalik,[1] and M. Fitta[2]

[1] *Institute of Experimental Physics SAS, Watsonova 47, 040 01 Košice, Slovakia*

[2] *Institute of Nuclear Physics Polish Academy of Sciences, Radzikowskiego 152, 31-342 Krakow, Poland*

Hole doped manganites systems have attracted significant scientific interest in the last few decades due to the variety of observed relaxation phenomena that resemble the behaviour of spin glasses. The origin of glassy dynamics was found in the frustration of the magnetic ground state, although the nature of frustration remains controversial. First it arises from the competition of super exchange (SE) Mn^{3+}–Mn^{3+} interaction, leading to antiferromagnetic (AFM) ordering and double exchange (DE) Mn^{3+}–Mn^{4+} mechanism which leads to ferromagnetic (FM) ordering. On the other hand, frustration is attributed to the formation of a phase-separated state. Phase separation implies the appearance of spatially confined magnetic clusters with magnetic coupling different from the surrounding FM background. Competing exchange interactions among clusters lead to additional frustration, which results in the appearance of spin glass like dynamics at low temperatures [1]. In our paper we present the results of a systematic study of nonequilibrium dynamics in $La_{0.80}Ag_{0.15}MnO_{3+\delta}$ magnetic nanoparticles system by ac susceptibility measurements using Cole–Cole analysis and by magnetization versus time measurements after zero field cooling (ZFC) and field cooling (FC) regimes in various fields and at various temperature. Nanoparticles were prepared by glycine – nitrate method and annealed at 800°C for 48 hours in different atmosphere (O_2 and Ar). The annealed samples crystallize in rhombohedral crystal structure ($R\overline{3}c$ space group). Sample prepared in O_2 has the volume of elementary cell 349.07 Å^3, the Curie temperature T_C = 320.5 K and the magnetic phase transition is sharp. Preparation in Ar results in smaller content of oxygen in sample, volume of elementary cell is 353.88 Å^3, T_C = 242.5 K, small maximum appears at T_1 - 41 K in magnetization and imaginary part of susceptibility χ", which we associate with AFM ordering due to SE interaction. The preparation of samples in different atmosphere enable us to perform comparative study of magnetic relaxation on systems with different content of Mn^{3+} and Mn^{4+} ions as well with different degree of magnetic phase separation.

References:

[1] M. Perovic *et al.*, Journal of Physics D: Applied Physics 46, 16500 (2013)

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