Giant Magnetoresistance with Temperature-dependent Crossover in $FeNi_3$-graphene Nanocomposites

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A dramatic temperature-dependent crossover from positive room-temperature Giant Magnetoresistance (GMR) to negative Low-field Tunneling Magnetoresistance (LFTMR) below 50 K is observed in FeNi3-graphene nanocomposites. Two clearly different behaviors have been discovered, being the temperature barrier ca. 50 K. The low-temperature behavior is particularly sensitive to low magnetic fields. The nanocomposites where synthesized by means thermal decomposition of a hybrid sebacate-intercalated layered double hydroxides as single source precursor. The as-synthesized nanocomposites consist on ferromagnetic FeNi3 nanoparticles embedded in a few-layers graphene matrix. This work represents a straightforward methodology based on chemical synthesis for the preparation of magnetoresistance materials offering great possibilities as GMR sensors.

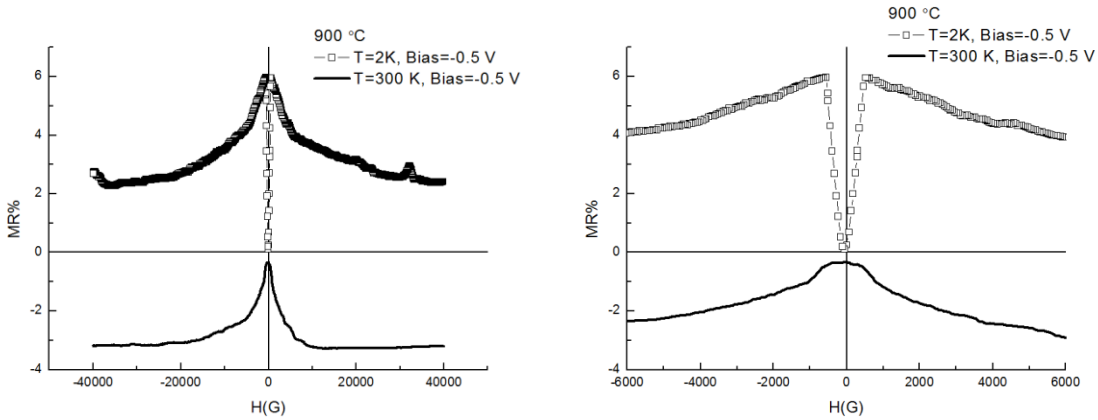

Figure 1: Magneto-Resistance for 900ºC nanocomposite, and the zoom of the Low magnetic field range.

All of our data suggest that we have a ferromagnetic nanoparticles/carbon matrix nanocomposite whose matrix conductivity can be tuned with temperature, thus offering the possibility of modulate the MR behavior. Moreover, all the rich MR phenomenology occurs under low fields. Our GMR granular nanocomposites can operate at room temperature or low fields in contrats to multilayered GMR materials, where a high magnetic field is required to saturate the MR, suggesting promising applications as GMR sensor