EFFECTS OF MAGNETIC INTERPARTICLE COUPLING ON THE BLOCKING TEMPERATURE OF ORDERED FERROMAGNETIC NANOPARTICLE ARRAYS

M. Knobel[1], W. C. Nunes[1], L. M. Socolovsky[1], J. C. Denardin[2], C.L.M. Espinoza[3], H. Winnischofer[3], D. Zanchet[3]

[1]Instituto de Física 'Gleb Wataghin', Universidade Estadual de Campinas, C.P. 6165, Campinas(SP) 13083-970, Brazil.
[2]Departamento de Física, Universidad de Santiago de Chile, USACH, Santiago, Chile.
[3]Laboratório Nacional de Luz Síncrotron, C.P. 6192, Campinas (SP) 13084-971, Brazil

Interest on magnetic nanoparticles has increased in recent years due to their intriguing scientific properties and potential applications in many important fields. In order to design such materials for specific applications, it is important to understand the intricate relationship between its magnetic properties and nanoscale-sized structural features. The major drawbacks of these systems are the randomness of clusters distribution in the matrix and the large dispersion of grain sizes and interparticle distances, which complicate the analysis of experimental results. Organized arrangement of assembled nanoparticle arrays rules out the complications introduced by positional randomness appearing in other nanoparticle-based systems. Moreover, these systems provide an excellent platform for studying the dynamic of the magnetization of a collective behavior caused by particle interactions. In this work we study the magnetic properties of a monolayer of organic-capped-iron-based spherical nanoparticles deposited with the Langmuir–Blodgett technique; and a 3D system of ordered nanoscopic Co crystals fabricated by sequential deposition The influence of magnetic interparticle coupling on superparamagnetic relaxation behavior is studied by means of DC and AC magnetization measurements. A quantitative analysis of the field dependence of the blocking temperature, considering particle coupling, is presented. We explain our results using a phenomenological model that takes into account particle coupling effects in superparamagnetic properties, based on the random anisotropy and micromagnetic theories.