Magnetic Nanoparticle systems studied by High Resolution Transmission Electron Microscopy

Leandro M. Socolovsky[1]
[1]*INTECIN – Facultad de Ingeniería, Universidad de Buenos Aires,Buenos Aires, Argentina*

Systems formed by nanometric sized structures are of great interest from both points of view, basic and applied. Due to their nanometric nature, these structures give place to new phenomena, as Giant Magnetoresistance, superparamagnetism or Giant Hall Effect, among others. These characteristics opened new fields for basic studies and are used in technological applications, such as drug delivery, medical therapies, magnetic paintings, very sensitive sensors or in data storage and magnetic RAM memories. Therefore it is very important to study the structure of these nanometric entities. Particularly interesting are the systems formed by nanometric particles, also called granular systems when the medium is a solid; or magnetic fluids when the medium is a liquid. In this seminary we will present results from studies made on different magnetic nanoparticle systems using High Resolution Transmission Electron Microscopy (HRTEM), in combination with others techniques. First we will present a study of Fe-Cu alloys, prepared by ball milling. Previous results indicated the formation of a fcc alloy presenting superparamagnetism and giant magnetoresistance [1]. Using HRTEM, and comparing with results of X-rays absorption spectroscopy (XAS), we corroborate a theoretical model of formation of this alloy and make a comparison with a first-principles calculation [2, 3]. We will also show a study by HRTEM in combination with small angle X-ray scattering (SAXS) of a magnetic fluid constituted of iron oxides nanoparticles capped with organic materials suspended in water. These fluids present very interesting characteristics of electric transport. With the use of both techniques we will try to give a picture of the observed behavior [4]. To finish we will show a study using HRTEM and SAXS of granular alloys Co-SiO2, in the search for the origins of the observed Giant Hall Effect [5].

Keywords: magnetic nanoparticles, HRTEM, SAXS, XAS, magnetotransport properties

Work supported by CONICET (Argentina) and LNLS (Brazil)

.

[1] O. E. Agüero, L. M. Socolovsky and I. L. Torriani; J. Metastable and Nanocrystalline Materials, 20-21 (2004) 648-653. M. B. Fernández van Raap, L. M. Socolovsky, F. H. Sánchez, I. Torriani, J. Phys.: Cond.Matter 14 (2002) 857 –864
[2] R. B. Schwarz, Mat. Sci. Forum, Vols. 269 - 272, 665 (1998).
[3] "Magnetic and Hyperfine properties of Fe-Cu clusters in Cu", A. B. Klautau, L. M. Socolovsky, R. N. Nogueira, and H. M. Petrilli, submitted to Physical Review B
[4] A. F. Bakuzis, E. R. Cintra; J. L. Santos Junior, L. M. Socolovsky, N. Buske, J. Magn. Magn. Mater. 320 (2008) e351-e353. L. M. Socolovsky, J. L. dos Santos Junior, A. F. Bakuzis; in preparation
[5] L. M. Socolovsky, C. L. P. de Oliveira, J. C. Denardin, M. Knobel, and I. L. Torriani; Phys. Rev. B, 72 (2005) 184423

lsocolovsky@fi.uba.ar
INTECIN – Facultad de Ingeniería, Universidad de Buenos Aires
Av. Paseo Colón 850 - C1063ACV - Buenos Aires - Argentina