Poster

Surface anisotropy, orbital moment and biomedical applications in magnetic nanoparticles

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Magnetic nanoparticles (NP) systems have long been subject to study finite-size and surface effects [1]. Besides, their potential application for biomedical purposes relies on high quality magnetic materials. The thermal decomposition of an organic iron precursor in an organic medium [2] allows the preparation of highly crystalline iron oxide NP with excellent magnetic parameters [3]. Particles in the 5-50 nm range were synthesized in the presence of a variety of coatings with controlled shapes. All the materials show a narrow size distribution with high crystal quality. Saturation magnetization was size independent in the 5-20 nm range and almost reached the expected value for bulk magnetite at low temperatures, higher in those NP with the surfactant covalently bonded to the surface. In 5 nm particles the surface contribution to magnetic anisotropy could be stablished via an analitical method that relies on the Tln(t/t0) scaling and demonstrates that surface anisotropy causes the broadening of their energy barrier distribution [4,5]. X-ray absorption spectra (XAS) suggested charge transfer from the NP to the covalent bonded surfactant. X-ray magnetic circular dichroism (XMCD) confirmed the dependence of the magnetic moment on the surface bond and suggested that the orbital momentum is more effectively quenched in covalently bonded NPs. Besides, the low-temperature <Sz> = 3.63 μB/f.u. obtained in the latter, is very close to those reported for bulk samples (3.90-3.95 μB/f.u.). High resolution TEM suggests that the foregoing is related to the crystal quality of the NP [6].

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