The g-factor of monodisperse composite nanoparticles

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The self-assembly of ferromagnetic nanoparticles is severely influenced by the magnetostatic interactions of the partcicles. To model the process quantitatively a detailled knowledge of the magnetic anisotropy and the magnetization of the particles is required. A well-known measure of the orbital magnetism which is related to the magnetic anisotropy is the g- factor. The spectroscopic splitting g-factor of 3d ferromagnets is proportional to ratio of the orbital-to-spin magnetic moment. Hence, g- factor measurements on nanocrystals containing 3d elements like Fe and Co provide a microscopic view of the magnetic properties. We present a g- factor determination for a)composite 3 nm FePt, b)CoO@Co (2nm CoO shell around a 8 nm Co core) and c)CoAg particles obtain by ferromagnetic resonance measurements at 9, 24, and 35 GHz. For the FePt particles with different Fe concentration we find a linear relationship between g-factor and Fe concentration. For lower Fe concentration we find a larger g- factor indicating that the presence of Pt induces an enhanced orbital magnetic moment in the nanoparticle. In the case of CoO@Co we find a bulk- like fcc Co g = 2.15. This finding is discussed in terms of ferrimagnetic resonance, since the measured g-factor is effectively given the complex magnetic response of the antiferromagnetic CoO shell interacting with the ferromagnetic Co core. In CoAg nanoparticles the g-factor strongly deviates from the bulk-like value, which will be discussed in terms of the polarization (hybridization) of the Ag in contact with Co and the presence of trace amounts of CoO. Supported by EC contract no. HPRN-CT-1999-00150