Poster

SYNTHESIS CONTROL AND MAGNETIC PROPERTIES OF CORE-SHELL Fe_3O_4@Au NANOPARTICLES.

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The preparation of size controlled metal-coated magnetic nanoparticles is increasingly important for exploring technological applications in different areas. Iron oxide nanoparticles have been studied as magnetic resonance contrast agents, in high-density magnetic recording or controlled drug delivery [1]. Gold coated magnetic nanoparticles enhance chemical stability and exhibit good biocompatibility [2]. Along the same line, we present controlled sized iron oxide nanoparticles coated with a gold shell and stabilized with oleic acid and oleylamine.

The preparation of Fe_3O_4@Au nanoparticles involved the previous synthesis of Fe_3O_4 from $Fe(acac)_3$ in the presence of 1,2-hexadecanodiol, oleic acid and oleylamine [3]. The reduction of $Au(OOCCH_3)_3$ in the presence of as-synthesized iron oxide seeds, with sizes of 5.7(3) and 3.6(2) nm, yield gold coated nanoparticles in the 5–7 nm range, surrounded by organic ligands. The synthesis method, iron and gold concentration and the nature of the solvents used for separation have been changed in order to optimize the preparation method. The characterization of the samples was performed by means of X-ray diffraction (XRD), transmission electron microscopy (TEM) and thermogravimetric analysis (TGA). Magnetic properties have been investigated using electron paramagnetic spectroscopy (EPR) and SQUID magnetometer.

The presence of Fe_3O_4 and gold was confirmed by XRD and the concentrations of the metals by energy-dispersive X-ray analysis. Transmission microscopy has shown particle sizes below 7 nm (Fig. 1), as well as a narrow size distribution. The nanoparticles contain between 10 -15% of capped ligands, as was observed in the TG-DTA curves of the samples recorded in air atmosphere.

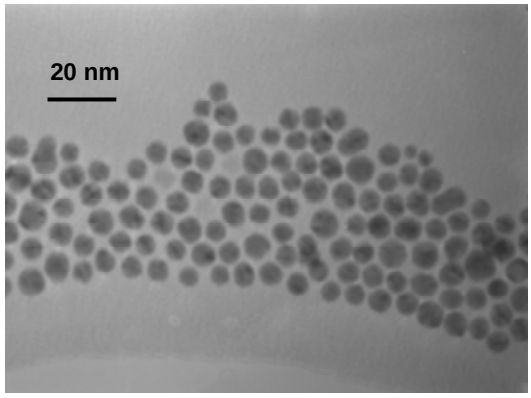

Fig. 1. TEM picture of Fe_3O_4@Au NPs.

Magnetic measurements show a different behavior depending on the nanoparticle size. For samples of 7.5 nm a ferromagnetic behavior is observed at room temperature. EPR measurements of these particles show a broad signal, which show an orientational dependence of the ferromagnetic resonance. An exhaustive study with temperature and orientation has been performed. Nanoparticles with lower size present susceptibility plots which exhibit a cusp in the ZFC curve, which corresponds to the blocking temperature, T_B. Above T_B, in the superparamagnetic regime no hysteresis loop is observed.

References:

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