


Preparation and Characterization of Monodisperse Fe₃O₄ Nanoparticles: An Electron Magnetic Resonance Study

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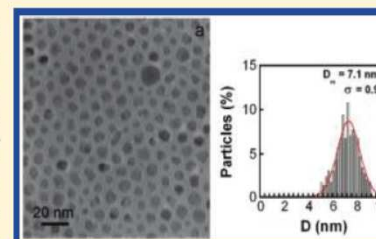
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 Supporting Information

ABSTRACT: One of the major challenges prior to a proper application of magnetic iron oxide nanocrystals is not only to understand the influence of the synthetic parameters on the final characteristics of the nanoparticles but also to optimize characterization methods in order to understand the magnetic behavior. First, a systematic study of the different parameters on a facile chemical synthetic route based on the thermal decomposition of iron(III) acetylacetonate, allowed a fine adjustment of the synthetic conditions to obtain oleic acid and oleylamine capped magnetite nanoparticles with perfectly defined size within 3.5–7 nm in diameter and organic content from 16.1 to 40.9%. Second, a complete characterization of samples by means of electron magnetic resonance (EMR) as a function of the angle and temperature was carried out. This technique allows to accurately elucidate the key characteristics of the deviation from the ideal superparamagnetic behavior observed in some samples by magnetic measurements. The optimization of the sample-handling for the EMR measurements emerged as a decisive step to provide reproducible results and to ultimately demonstrate that the lack of organic content adsorbed on the nanoparticle surface favored a ferromagnetic behavior. Furthermore, resonance lines ascribed to forbidden $\Delta M_S = \pm 2$ transitions were observed in the EMR spectra of this system, which open up new research possibilities for evaluating interparticle interactions.

KEYWORDS: Nanoparticles, nanomaterials, magnetism, electron magnetic resonance



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