

Synthesis and magnetic properties of CoFe_2O_4 spinel with nanometric size.

V. Blanco¹, M. J. Torralvo¹, R. Sáez¹, E. Legarra², F. Plazaola²

¹Depto. Química Inorgánica, Facultad Ciencias Químicas, Universidad Complutense, 28040 Madrid, Spain.

²Depto. Electricidad y Electrónica, UPV/EHU, Aptdo. 644, 48080 Bilbao, Spain.
veronicabg@quim.ucm.es

There is a growing interest in nanomaterials as they present different properties than their bulk counterparts. This fact makes possible to have a new variety of technological applications of these materials. In this work, nanosized spinel with different magnetic properties to their bulk counterparts, have been prepared.

Two samples of CoFe_2O_4 with different particle size were synthesized by the solvothermal method. Firstly, stoichiometric amounts of iron nitrate and cobalt nitrate were dissolved in water (for the 20 nm sample) or ethylenglycol (in the case of the 6 nm sample) and later, KOH was added as precipitant agent. The resultant mixture was transferred into an autoclave to be treated at 180° C for several hours (1).

X-ray diffraction data reveal that pure CoFe_2O_4 with spinel structure was obtained in both cases. It can be seen in the TEM images that both samples present homogenous particle size and polyhedral shape. It is worth noting that in the case of the sample with bigger particle size, well defined octahedral were obtained (see figure 1).

Different magnetic data depending on the particle size of the Co-ferrite were obtained and indicate that both samples behave as superparamagnetic. It can be seen that the coercive field increases as the particle size does as well as the blocking temperature corresponding to the maxima seen in the susceptibility curve (see figure 2). Mössbauer spectroscopy study confirms this behaviour showing a sextet structure below the blocking temperature, and a doublet above this temperature according to the previous work done by Manova et al. (2).

References:

- [1] R. Saez Puche, M. J. Torralvo Fernandez, V. Blanco Gutierrez, R. Gomez, V. Marquina, M. L. Marquina, J. L. Mazariego, R. Ridaura, Bol. Soc. Esp. Ceram.V., **47**, 3 (2008) 133.
[2] Manova et al., Chem. Mater., **16**, 26 (2004) 5689.

Figures:

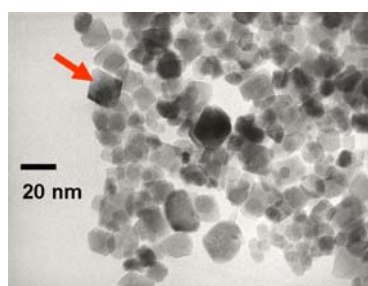


Fig. 1 Octahedral particles of Co-ferrite obtained by hydrothermal method.

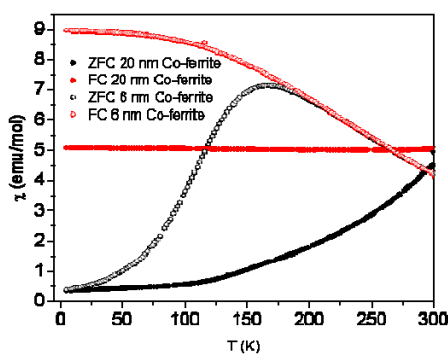


Fig. 2 Magnetic susceptibility for samples of CoFe_2O_4 with 20 nm and 2 nm particle size.

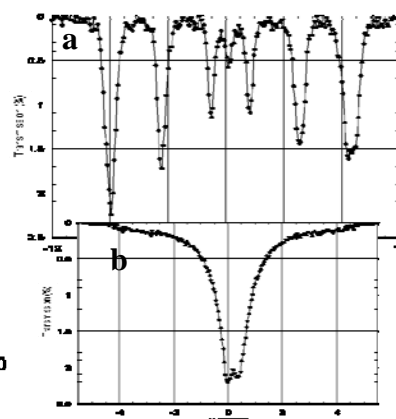


Fig. 3 Mössbauer spectra for 2 nm Co-ferrite at 55 K (a.) and room temperature (b.).