Wet-chemistry methods for the synthesis of anisotropic nanoparticles with different magnetic order

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In the last decade interesting magnetic properties have been reported for nano-crystalline magnetic particles for which the importance of size and shape is well known. These materials have been widely used in the electronics industry for the fabrication of components, in ferrofluids, sensors and biomedical applications.

We propose two wet-chemistry processes that allow the synthesis of anistropic magnetic nanoparticles of very different materials that therefore offer different magnetic properties.

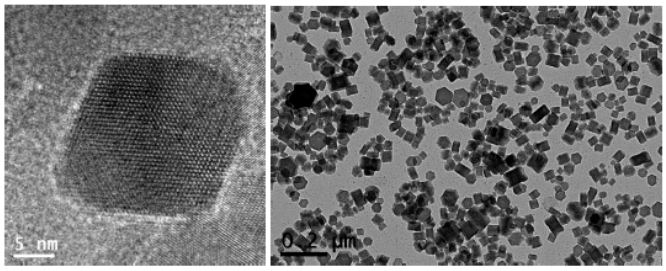
Ferrimagnetic ferrite nanostructures (MFe_2O_4, M: Mn, Fe, Co, Ni, Zn) with cubic shapes can be synthesized following a new wet-chemistry method based on the thermal decomposition of metal precursors [1] and on the growth of the nanostructures controlled by amines. Before studying their magnetic properties control over their size, shape (cubooctahedral in the left TEM image) and polydispersity has been achieved by means of the synthesis conditions.

Antiferromagnetic Cr_2O_3 nanoparticles can be synthesized by means of the calcination of the chromium hydroxide precursor $Cr(OH)_3$, previously obtained by precipitation in the presence of sodium hydroxide.[2] The final nanoparticle shape (mainly cubic but also hexagonal in the right TEM image) can be controlled by changing the ligands in the initial solution during the coprecipitation.

References

[1] B. Yuhas, D. Zitoun, P. J. Pauzauskie, R. He, P. Yang, Angew. Chem. Int. Ed., **45** (2006) 420.
[2] M. Bañobre-López, C. Vázquez-Vázquez, M. A. López-Quintela, J. Rivas, Nanotech. **14** (2003) 318.

Figures



(HR)TEM images of $ZnFe_2O_4$ (left) and Cr_2O_3 (right).