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Superparamagnetism in $CoFe_2O_4$ nanoparticles: an example of a collective magnetic behavior dependent on the medium.

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Abstract

Cobalt ferrite particles with homogeneous microstructure have been prepared encased in MCM (Mobil Composition Matter) and SBA (Santa Barbara Amorphous) silica mesoporous structures. In addition, it was possible to obtain ferrite nanowires once the silica matrix was dissolved. The variety of samples prepared has allowed to deeply analyze the matrix effect in the magnetic behavior of these particles that behave as superparamagnetic at room temperature. It was found at 5 K, a drastic magnetic hardening of the encased ferrite particles due to the employment of such matrices, while no matrix effect was observed at 250 K.

Introduction

Nanoscience is one of the most important research areas that explores not only the exotic properties of the materials as consequence of the reduction of their particle size but also the way of tailoring their properties by modification of the material microstructure.[1, 4] Finite size effects are dependent on the particle size up to a critical dimension from which larger sizes exhibit bulk behavior. Several examples can be