Effect of the nature and the particle size on the properties of uniform magnetite and maghemite nanoparticles

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Magnetite nanoparticles with two different sizes, 5 and 17 nm (Figure 1), have been prepared by decomposition of organic precursors in an organic media in the presence of oleic acid. The particles have been characterised by TEM, X-ray diffraction, Infrared and Mössbauer spectroscopy in order to clarify their structural and physicochemical properties. The samples consist on non-interacting magnetite nanoparticles in both cases with a more uniform size distribution and higher crystal order degree than particles of similar sizes prepared by coprecipitation. A controlled heat treatment of the samples in air leads to the transformation of magnetite to maghemite which can be followed by the appearance of many IR bands forbidden for a spinel structure. In addition to that, an important reduction of saturation magnetisation and coercivity at low temperature takes place whenever the oleic acid is preserved. Finally Mössbauer spectra at different temperatures clearly shows the effect of the nature of the iron oxide phase, the particle size, particle interactions and structural order at the surface in both, magnetite and maghemite as a consequence of the oleic coating.

Figures:

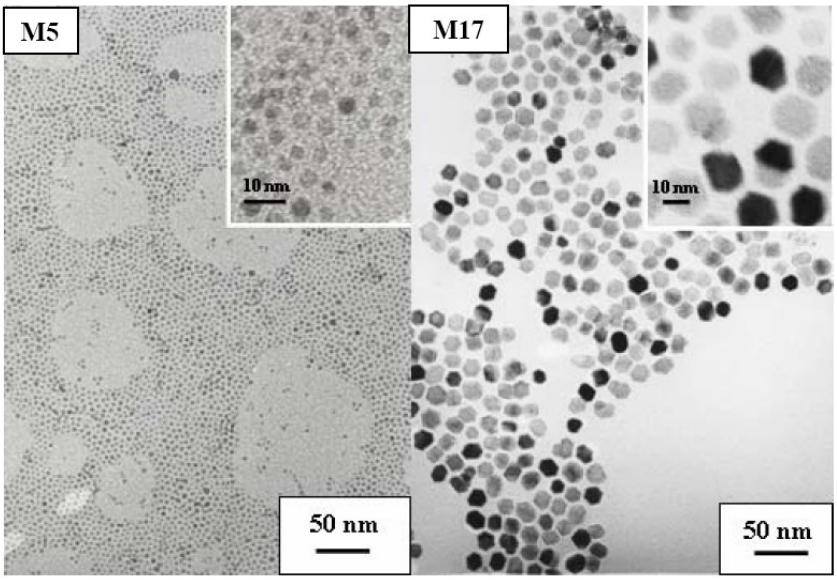

Figure 1. TEM images of magnetite nanoparticles of 5 nm (left) and 17 nm (right**).**