

Magnetic nanoparticles

For several years we are engaged in the synthesis of magnetic nanoparticles (NPs) In a first approach, we have developed the synthesis of monometallic NPs of Co, Ni or Fe. Then, taking advantage of the versatility of our organometallic-synthetic approach, we looked at the preparation of alloys: CoM, M= Rh, Ru, Pt, Fe. More recently, we started the study of metal oxides like iron oxides by the extension of the organometallic synthetic method developed for the preparation, *at room temperature*, of crystalline ZnO NPs (Figure 1).

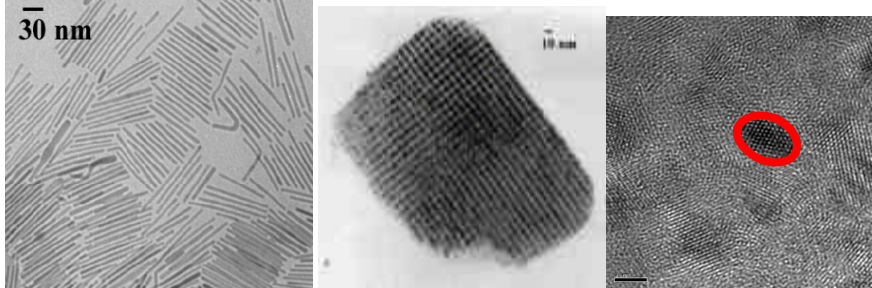


Figure 1:
a) Co nanorods
b) Fe nanocubes
c) γ -Fe₂O₃ nanoparticles

We are following several goals: the understanding of reduction-size effects, shape effects, the structural-properties relations, but also the effects of the ligands at the surface of the particles on the magnetic properties (Figure 2).

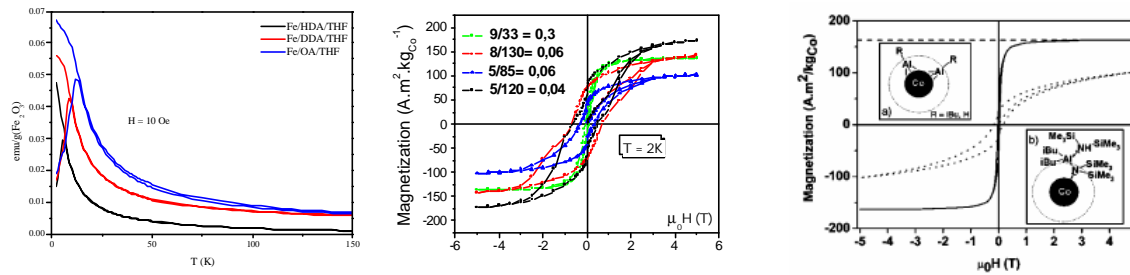


Figure 2: from left to right: size effect, shape effect, and ligand effect on the NPs magnetic properties

During these studies we are using different technics allowing the determination of the structural and magnetic properties of the NPs with WAXS, TEM, HRTEM, EXAFS, Mössbauer, SQUID, and XMCD measurements. We have shown that one of the first effects of size reduction is the formation of new crystallographic structures (Figure 3).

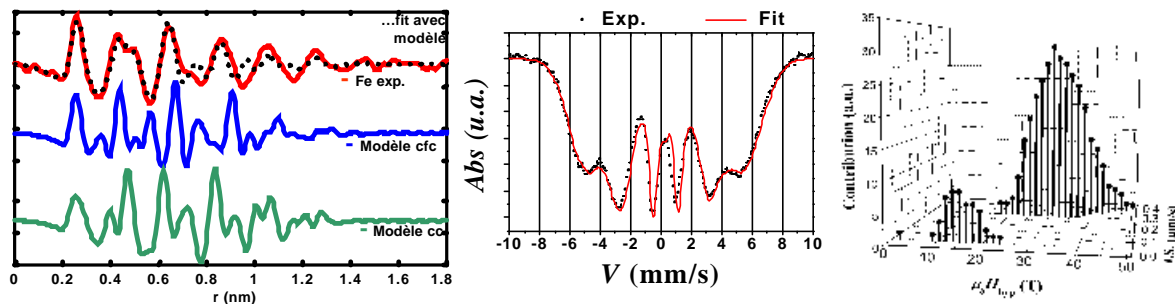


Figure 3: La FDR associée aux NPs de Fe de 1.8 ± 0.5 nm, déterminée par WAXS, montre que l'arrangement atomique est différent de ceux observés dans le massif à cette même composition. Le spectre Mossbauer peut être ajusté à l'aide de deux contributions (atomes de cœur et de surface).

Our studies lead to the development of collaboration with Freescale Semiconductors SA for the improvement of integrated inductors.

Selected references:

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