

Experiment title: Investigation on the magnetic correlation length in FePt nanoparticles in granular FePt/C multilayer by Magnetic GISAXS

Experiment number:
MI - 790

Beamline:
ID 12

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18

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Report:

In this experiment, our intention was to perform Magnetic Grazing incident small angle x-ray scattering (Magn-GISAXS) experiments on granular FePt/C superlattice at the Pt L edges. Fig 1. illustrate the typical Magnetic low angle scattering we succeed to measure at the Pt L edges. To ensure the reliability of the measurement, both the incoming beam polarization and the magnetic field have been reversed.

The analysis of the scattering data is still under analysis. But as in in the same beamtime we also recorded x-ray magnetic circular dichroism data for several sample depending of the matrix element (C, Si, etc) and the percent of the sample being ordered in the FePt L1₀ phase (induced by annealing). Already, from the X-ray absorption and magnetic circular dichroism spectra of as-deposited and post-annealed Fe₅₀Pt₅₀/C granular multilayers we demonstrate that the partial L1₀ ordering of the FePt nanoparticles induced by thermal annealing results in an increase of the effective spin magnetic moments by 200% at the Fe site and by 65% at the Pt site. The orbital moments are enhanced by 325% and 15% at the Fe and Pt sites, respectively. In addition, a change in the x-ray absorption

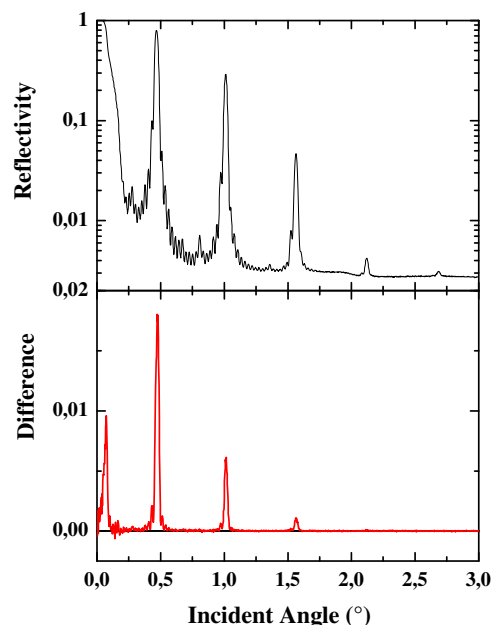


Fig 1. Top : XLow angle resonant scattering. Bottom: Magnetic contrast recorded at the Pt L edge.

near-edge structure at the C K edge gives evidence for a preferential graphitization of the carbon matrix, which provides a better protection of the nanoparticles against external degradation as required for the application of these particles in future magnetic devices. The figure 2 is also typical from the results we got for XMCD spectra at the Pt $L_{2,3}$ edges.

We would like to report that the XMCD work done during the allocated beamtime for this experiment have been already the object of oral presentation [1] and already one paper have been submitted for publication in Applied Physics Letters [2].

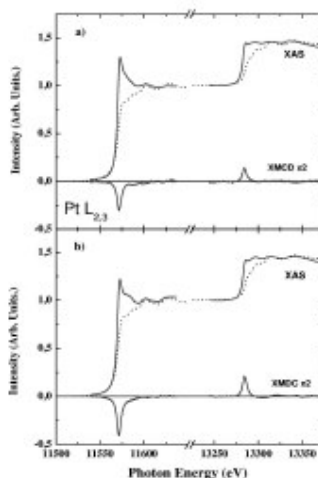


FIG. 2: Pt $L_{2,3}$ XAS and XMCD spectra measured at room temperature for carbon-encapsulated $\text{Fe}_{50}\text{Pt}_{50}$ nanoparticles (a) as-deposited and (b) post-annealed in vacuum at 500°C for 2 hours. The dotted lines represent Au $L_{2,3}$ reference spectra on a shifted and stretched energy scale. The XMCD spectra are scaled by a factor 2.

[1] N. Jaouen, Invited Talk, XRMS 2007, Grenoble 2007

[2] N. Jaouen, D. Babonneau, J.M. Tonnerre, D. Carbone, F. Wilhel, A. Rogalev, T.K. Johal, G. van der Laan, submitted to Applied Physics Letters. Submitted.