Wavelength-dependent magneto-optical coercivity in cobalt ferrite nanoparticles

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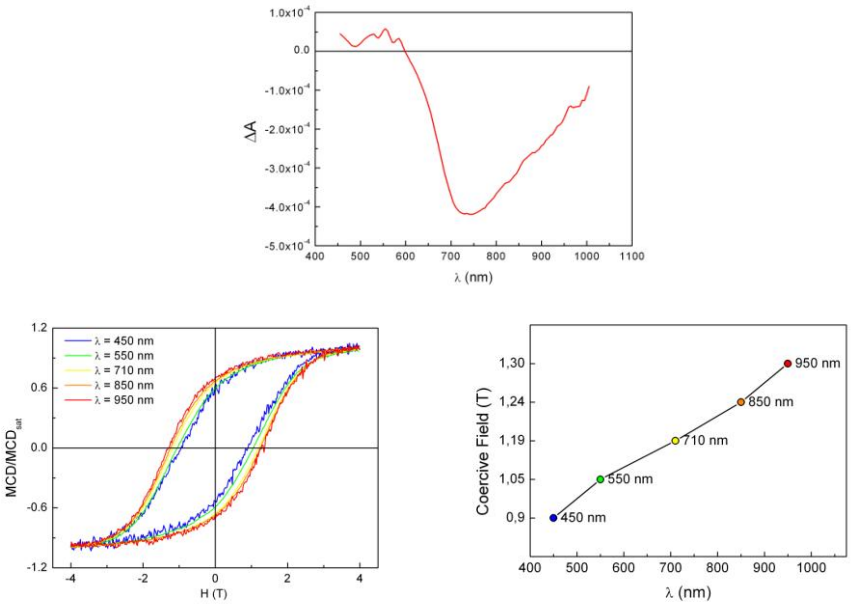
Polarized photons are powerful probes to enucleate magnetic properties of nanoparticles: their interaction with materials returns information in which spin population and spectroscopic attributes are intertwined. In particular, the possibility of using photons of different energy allows to separate contributions arising form different phases of the material and to link magnetic properties to single electronic transitions or delve into more elaborate physical mechanisms otherwise very hard - if not impossible - to observe.

We recently carried out an extensive magneto-optical (MO) study using magnetic circular dichroism (MCD) at cryogenic and room temperatures on magnetite and cobalt ferrite nanoparticles to correlate structural and stoichiometric parameters to their MO response, and found clear correlations between particle composition and MCD spectrum.

In addition to this by recording hysteresis loops using as a probe light of different wavelengths (i.e. sampling different spectral regions), we found that coercivity in cobalt ferrite depends strongly (>30%) and linearly on the wavelength used as a probe (see figure). Comparison SQUID-based experiments carried out under irradiation confirm that the effect is not due to light-induced heating or charge transfer due to photon absorption. The mechanism underlying this effect is still under debate and is likely to be related to the polarisation of valence band transitions of the material with respect to the axes of anysotropy of single cobalt ferrite nanocrystals.

Figures



(Top) MCD spectrum of a Cobalt ferrite nanoparticle sample at 2 K under 5 T applied field. (Bottom left) wavelength-dependent coercivity (2 K) of the same sample and (Bottom right) plot showing the linear dependence of coercivity vs wavelenght