Proposition of M2 internship 2016-2017
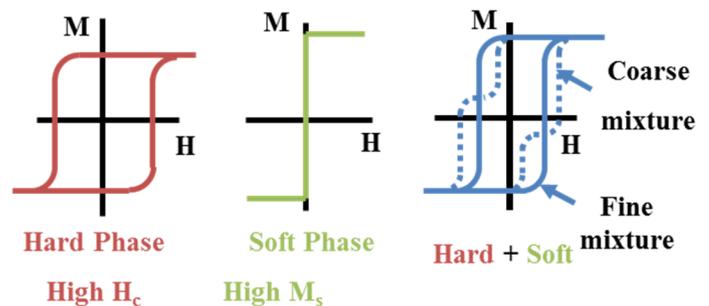
Nanocomposite Magnets for Energy

Context of the study :

There is a growing demand nowadays for high performance magnets, notably for green Energy application such as electric motors and generators. Until now, the breakthroughs in magnet research is based on $Nd_2Fe_{14}B$, discovered in the 80's. However, the monopoly of such compound causes a problem of heavy rare earth ressources. Therefore, there is a need for alternative hard magnetic materials.

A promising route is to fabricate nanocomposite materials made of a fine mixture of a hard and a high magnetization phase. When the coupling is controlled at the nanoscale, theoritical models predict superior performances than the current permanent magnets.

Description of work :

This internship is mainly focused on the experimental development of new model systems of nanocomposite magnets and to assess their magnetic performances. It will first consist of testing the potential for soft-in-hard nano-composite by using cluster/matrix co-deposition processes. Indeed soft FeCo nanoparticles will be prepared by Low Energy Cluster Beam Deposition (LECBD) then be embedded into a hard FePt matrix. The evolution of magnetic hardness with the ratio between the two phases together with cluster size will be studied by advanced magnetization measurements and simultations.
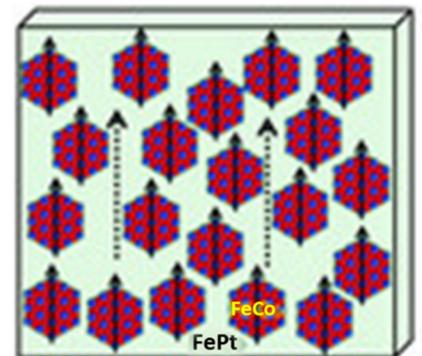
This work is intended to lead to a thesis with the support of SHAMAN ANR, a collaboration between iLM, Néel Institute and ESRF at Grenoble.

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