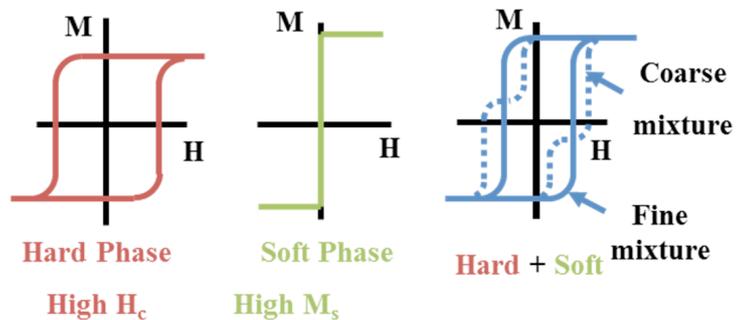M2 internship
Nanocomposite magnets for energy

Context of the study:

There is a growing demand nowadays for high performance magnets, notably for green energy technologies such as motors in electric vehicles or wind turbine generators. In terms of materials, since the 80's, Nd2Fe14B-based magnets are by far the most performant and cost effective. However, the monopoly of such compound causes problems of price fluctuations. 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 phase with a high magnetization phase. When the microstructure 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 magnet films, and the assessment of their magnetic performances. It will first consist in testing the potential for soft-in-hard nano-composite by using size-selected clusters and matrix co-deposition processes. Indeed soft $Fe_X Co_{1-X}$ 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.
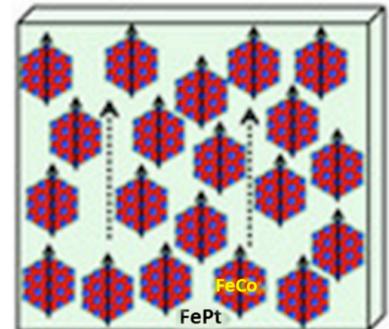
This work is intended to lead to a thesis with the support of SHAMAN ANR, a collaboration between iLM, Néel Institute and ESRF at Grenoble.

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