Vectorial FORC-based measurement designed for probing anisotropy in multi-component ferromagnetic systems.

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The magnetic characterization technique based on the experimental first-order reversal curves (FORC) diagrams [1,2] is scalar in essence and as a result deals with two components, one irreversible related to magnetic switchings in the sample between two energy minima but also with a reversible component [3,4]. The second component is not really well understood and has two main sources: i) the reversible changes in the magnetic entities in field ranges which does not imply switches; and ii) magnetization changes due to relaxation processes in the magnetic ensemble. This manner of interpretation of the scalar FORC diagram measurement is related to the fact that an essentially vectorial process is represented in a scalar manner. As the scalar FORC measurement (sFORC) becomes very popular in the laboratories around the world there is a strong interest in the extension of the FORC technique towards a fully vectorial form (vFORC) able to provide supplementary data about the magnetic samples. For example, at this moment, a number of groups are systematically measuring a number of sFORC diagrams for different angles between the easy axis of the sample and the applied field direction [5]. However, this type of measurement is time intensive and does not provide always substantially more information than a simpler sFORC diagram.

In this presentation we shall show the results obtained by us in developing a simple and comprehensive tool which has the potential to become the future standard for a vFORC diagram technique. It is shown that this methodology is really sensitive in deconvoluting the contributions given by the components of different anisotropies in a given sample. Also of interest is to find the fingerprint due to different anisotropies types.

The results obtained experimentally are compared with physically accurate micromagnetic simulations of these samples in order to understand the performances and the limits of this tool.

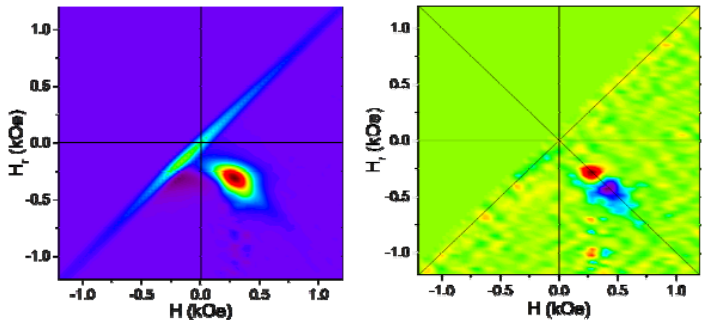

Figure Experimental vFORC dual diagrams of a two anisotropy components system.

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