

Third Laureate Applied Research



- **Project title:** Design and fabrication of Alternating Gradient Force Magnetometer (AGFM), equipped to measure First Order Reversal Curve (FORC)
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Abstract:

The Alternating Gradient Force Magnetometer (AGFM) is a highly sensitive instrument mainly suited for thin films magnetometry. This measurement method is based on the alternating force produced on a magnetized sample via two gradient coils. The so-induced sample oscillation is directly proportional to the sample's magnetization. High sensitivity measurements are attained by load the sample at the end of a probe. The probe include of the piezoelectric sensor, which detects the oscillating force, and the resonant cantilever, which allows the amplification of this force. The field gradient produced through gradient coils and the horizontal sample motion is detected by a symmetrical piezoelectric bimorph connected to a lock in amplifier. The magnitude of the deflection is proportional to the total moment of the sample. The gain in sensitivity over a conventional VSM is about equal to the Q factor of the mechanically resonant system, generally 50 to 100. Accordingly the commercial AGFM has a claimed sensitivity of 11-10 Am² or 0.01 μ emu.

First Order Reversal Curves (FORC) diagram is a new tool that is used to analyse magnetic properties of ferromagnetic materials. The AGFM equipped with a new system to be able to plot the FORC. This AGFM is able to plot magnetic loops, Switching field distribution, δM curve and FORC of thin films, powders, magnetic nanowires and magnetic nanotubes.

