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XRMS study of stripe domains in amorphous NdCo5 thin films with an in-plane anisotropy induced by oblique angle deposition

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Magnetic stripe domains have interesting properties, like unidimensional periodicity and rotatable anisotropy [1], which makes them suitable for spintronics applications like reconfigurable spin wave guides [2] or domain wall racetracks [3]. The understanding of the mechanisms that permit these kinds of applications requires a complete characterization of the magnetic stripes. X ray Resonant magnetic scattering (XRMS) seems an ideal tool for this purpose due to its sensitivity to magnetic stripe domains characteristics [4] with no restrictions of field intensities or temperature, and with enough intensity to allow magnetic stripe dynamics [5]. In this work, we present XRMS measurements of the stripe domain configuration in amorphous NdCo5 thin films, 65 nm thick, with weak perpendicular magnetic anisotropy (PMA) used as hard magnet substrate for different magnetic applications [1,2]. These thin films increase their PMA energy with film thickness, being close to the maximum value at the thickness studied. The films are deposited by magnetron sputtering with an oblique angle incidence for the Nd atoms (30°) which induces a magnetic easy axis in the plane. Several features appear in the XRMS stripe pattern of the films that are connected to their magnetic morphology: The shape of the XRMS peaks related to the periodicity of the stripes changes in width depending on the orientation of the beam with respect to the in-plane magnetic easy axis. The peaks have a small but visible transfer moment component, q, parallel to the plane of incidence which is absent in samples where the oblique incidence effect is reduced by rotating the sample during film deposition. The evolution of these features was measured as a function of the applied field. This experiment demonstrates the high sensitivity of XRMS to magnetic features that are not obvious to deduce with other magnetic moment sensitive techniques.

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