



Magnetic Microscopy of Domains and Domain Walls in Ferromagnetic Nanotubes

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The project was concerned with exploration of magnetic domains and domain walls (DWs) in magnetic nanotubes and more complex geometries such as multilayered core-shell nanotubes and diameter modulated nanowires. Upon miniaturization, arrays of such structures could open the way for 3D spintronics: tubular synthetic antiferromagnets, novel sensors and non-volatile solid state memories.

The project involved the synthesis, numerical modelling and advanced magnetic microscopies. We considered multilayered tubes with magnetic (Ni, NiCo, CoNiB, NiFeB) and non-magnetic layers. We provided the first magnetic microscopy images of well-defined

domains and DWs in magnetic nanotubes. In core-shell structures we could probe selectively the magnetic domains in different layers using element sensitive X-ray microscopy (see fig. 1). By exploiting the shadow created by partially absorbed X-rays with low angle of incidence, we obtained images of magnified (by a factor of 3.6 along the beam) projection of magnetic domains. We also observed the evolution of domains when subject to an applied magnetic field.

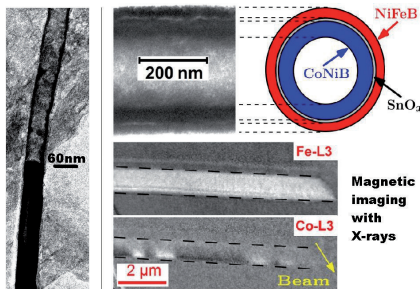


Fig.1 : Left: Wire-tube element; Right: multilayered tube with layered-resolved magnetic images using the shadow of X-rays.

OUTCOMES

[1] Probing domain walls in cylindrical magnetic nanowires with electron holography, J. Phys. Conf. Ser. 903, 012055 (2017).

[2] Imaging magnetic flux-closure domains and domain walls in electroless-deposited CoNiB nanotubes, arXiv:1704.06614 (2017).

Oral presentations: EMS 2016, Glasgow, United Kingdom, 2016. InterMag, Dublin, Ireland, 2017. CLN2017, Paris, France, 2017. JEMS 2017, Mainz, Germany, 2016.

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