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Hysteresis Design of Magnetic Materials for Efficient Energy Conversion

Tuesday, 23 Feb. 2021, 9:00 s.t., TU Darmstadt, Zoom



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Zoom information:

Meeting-ID: 864 0962 2789

Kenncode: 113174

Fabrication, micro-patterning and use of high performance NdFeB films

Abstract:

Excellent hard magnetic properties (high coercivity, high remanence) have been achieved in Nd-Fe-B films produced by many groups using physical vapour deposition techniques such as sputtering, pulsed laser deposition and molecular beam epitaxy. On the one hand, such films can serve as model systems to study the link between microstructure and extrinsic magnetic properties. On the other hand, they can be used to produce miniaturized magnetic field sources for applications in micro- and nano-systems. In the latter case, the films must be patterned at a length scale comparable to the film thickness, because of the demagnetising field effect. In this talk I will begin by outlining the interest for micro-magnets and the potential they hold for the development of magnetic micro-systems. I will recall our earlier work on the fabrication, patterning and characterisation of NdFeB films [1-4]. I will then present very recent studies of specific aspects of film growth [5] and will show how we are now capable of the batch fabrication on 100 mm Si substrates of micro-magnets of thickness up to 50 μm [6]. I will show some examples of the use of our micro-magnets to date and will finish by discussing prospects for their future use in micro-scaled devices (motors, generators, actuators, sensors...), with applications in fields as diverse as telecommunications, energy management and bio-technology.

[1] N.M. Dempsey et al., "High performance hard magnetic NdFeB thick films for integration into Micro-Electro-Mechanical-Systems", Appl. Phys. Lett. 90 092509 (2007)

[2] A. Walther et al., "Micro-patterning of NdFeB and SmCo magnet films for integration into Micro-Electro-Mechanical-Systems", J. Magn. Mag. Mat. 321 (2009) 590–594

[3] F. Dumas-Bouchiat et al., "Thermo-magnetically patterned micro-magnets", Appl. Phys. Lett. 96, 102511 (2010).

[4] M. Kustov et al., "Magnetic characterization of micropatterned Nd-Fe-B hard magnetic films using scanning Hall probe microscopy", J. Appl. Phys. 108 063914 (2010)

[5] F.O. Keller et al., in preparation

[6] <https://www.linksium.fr/en/projects/micromagfab>

About the speaker:

Nora Dempsey received her PhD from Trinity College Dublin in 1998 and her HDR (Habilitation à Diriger des Recherches) from Université Joseph Fourier, Grenoble in 2012. Following her thesis, she was a Marie Curie postdoctoral fellow at Laboratoire Louis Néel, CNRS in Grenoble. She was hired as a Junior Scientist (Chargée de Recherche) at CNRS in 2001 and was promoted to Senior Scientist (Directeur de Recherche) in 2014. She is a member of the Micro and Nano Magnetism group at Institut Néel. Her research interests include the study and development of functional magnetic materials in film form, with a particular emphasis on hard magnetic materials. She has been involved in many collaborations with both academic and industrial partners at national and international levels.

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