# MM 24: SYM Thin Film Magnetic Materials: Microstructure, Reaction and Magnetic Coupling III

Time: Wednesday 14:00–15:30 Location: H 1058

**Invited Talk** MM 24.1 Wed 14:00 H 1058

**Nanoscaled domain structures and magnetization processes in thin films** — •Volker Neu, Cristina Bran, Felix Fleischhauer, Aarti Singh, Ulrike Wolff, and Ludwig Schultz — IFW Dresden, P.O. Box 270116, 01171 Dresden, Germany

Magnetic thin films and multilayers display a fascinating variety of domain structures and magnetization processes due to competing interactions. For single layers one has to consider intra- and intergrain exchange interactions and magnetostatic interactions versus complex anisotropies. In multilayer systems, additional interlayer interactions (e.g. exchange bias, antiferromagnetic or ferromagnetic coupling) broaden the range of possible coupling scenarios and thus the diversity of the magnetic behavior.

For a microscopic understanding of the magnetization processes we perform magnetic force microscopy (MFM), which offers a direct observation of the domain structure on a length scale down to 10 nm, and its evolution in a magnetic field. We present multilayers with perpendicular anisotropy and antiferromagnetic interlayer coupling of the type $[(\mathrm{Co/Pt})_X\mathrm{Co/Ru}]_N$, which possess complex antiferromagnetically and ferromagnetically coupled domain structures, depending on temperature and magnetic history. As an example of a highly anisotropic single layer film with in-plane easy axis orientation, the magnetization process of a nanocrystalline epitaxial $SmCo_5$ film is investigated. Whereas the magnetizing process proceeds on a small length scale of 100 nm, in the demagnetizing process the switching occurs via a fast propagation of few interaction domain walls.

**Invited Talk** MM 24.2 Wed 14:30 H 1058

**Coherent Control of Spin Torque Dynamics** — •Hans Werner Schumacher[1], Santiago Serrano-Guisan[1], Karsten Rott[2], Günter Reiss[2], Jürgen Langer[3], and Berthold Ocker[3] — [1]Physikalisch-Technische Bundesanstalt, Bundesallee 100, 38116 Braunschweig — [2]University of Bielefeld, Universitätsstr. 25, D-33615 Bielefeld — [3]Singulus Nano Deposition Technologies GmbH, Hanauer Landstr. 103, 63796 Kahl am Main

We study time resolved precessional magnetization dynamics induced by spin momentum transfer in nanopillars of CoFeB/MgO/CoFeB magnetic tunnelling junctions (MTJ). Spin transfer torque precession of the CoFeB free layer is excited by ultra short current pulses (0.1 to 5 ns duration) with current densities around 10ˆ6 A/cm2. The time resolved precession of the free layer is studied by measuring the time resolved magneto resistance change of the MTJ using a fast sampling oscilloscope. Our setup allows both to detect the spin torque precession during the current pulse and the magnetization ringing after pulse termination. From the decay of the precession we can derive the effective Gilbert damping parameter of the MTJ free layer. We show that by adapting the duration of the excitation pulse to integer multiples of the period of the spin torque precession the magnetization ringing can be coherently suppressed. Such coherent control of spin torque dynamics is a prerequisite for ultra fast ballistic spin transfer torque magnetization reversal.

**Invited Talk** MM 24.3 Wed 15:00 H 1058

**KeV-He-ion bombardment induced magnetic modifications and patterning of magnetic thin film systems** — •Arno Ehresmann — Institute of Physics and CINSaT, University of Kassel, Heinrich-Plett-Str.40, D-34132 Kassel, Germany

The exchange bias effect in antiferromagnet/ ferromagnet magnetic thin film systems results from the exchange interaction at the interface between both materials. Recently a method has been developed to initialize and tailor the exchange bias in direction and absolute magnitude by bombardment with light ions in a magnetic field [1]. The origin of this effect is a combination of interface and anisotropy modification in the magnetic thin films by the impinging ions. In combining ion bombardment with lithographical techniques a lateral magnetic patterning essentially without change of the surface topography becomes feasible. Besides a brief review of the currently discussed model for the keV-He-ion bombardment induced effects [2], examples for the various possibilities to apply these technique will be given, i.e. among others, tailoring magnitude and direction of the magnetic reference electrode's magnetization in giant magneto and tunnel magneto resistance layer stacks, production of standard samples to magnetically characterize magnetic force microscopy probe tips in in-plane magnetic fields, and positioning of magnetic particles.

Refs.: [1] A. Ehresmann, Recent Res. Devel. Applied Physics 7, 401-21 (2004), [2] A. Ehresmann, D. Junk, D. Engel, A. Paetzold, K. Röll, J. Phys. D. 38, 801-6 (2005)