MM 18: SYM Thin Film Magnetic Materials: Microstructure, Reaction and Magnetic Coupling I

Time: Tuesday 10:15–11:15 Location: H 0107

Invited Talk MM 18.1 Tue 10:15 H 0107

Local Probing of Magnetic Properties by Electron Microscopy — •Josef Zweck — NWF II - Physik, Universität Regensburg

Presently, huge efforts are made to combine magnetism with sensors or other electronic devices, or to simply use patterned magnetic materials for data storage. Frequently cited applications include GMR-based magnetic field sensors, spin transistors or "spintronics"and magnetic random access memories (MRAMs). The existing as well as future applications require the ability to manufacture magnetic devices far below the micrometer range and to characterize them.

One of the few techniques capable to investigate magnetic properties of **individual** magnetic particles with both high lateral (5 nm) and magnetic (2.5 Tnm) resolution is electron microscopy. The talk will demonstrate the ability to characterize individual magnetic particles and the dependence of the magnetic properties on their size and geometry. While control of size and shape can lead to the design of magnetic properties (single domain switching, taylored hysteresis loops, superparamagnetic behaviour) the lack of precise control can lead to arbitrary switching behaviour and unexpected domain structures.

MM 18.2 Tue 10:45 H 0107

Nanoscale characterization of electroplated, thick permalloy films — •Michael R. Koblischka[1], Saleh Getlawi[1], Martin Theis[2], Anjela Koblischka-Veneva[3], Monika Saumer[2], and Uwe Hartmann[1] — [1]Institute of Experimental Physics, Saarland University, P.O.Box 151150, D-66041 Saarbrücken, Germany — [2]Department of Microsystems Technology, University of Applied Sciences, Campus Zweibrücken, Amerikastrasse 1, D-66482 Zweibrücken, Germany — [3]Institute of Functional Materials, Saarland University, P.O.Box 151150, D-66041 Saarbrücken, Germany

Permalloy (Py) samples were fabricated by means of electroplating, (1) a patterned Py film on a Si wafer and (2) a NiFe foil. The grain sizes of the samples were measured employing AFM and TEM to be of the order of 50 nm (type (1)) and around 200 nm (type (2)). TEM further reveals that along the substrate, larger elongated grains are located, and after this layer, the regular grain growth sets in. Electron backscatter diffraction (EBSD) was employed to obtain Kikuchi patterns of Py which can be unambiguously identified due to the thickness of the samples, and via them the individual crystallographic orientation of the grains. The samples required a mechanical polishing procedure down to 40 nm colloidal silica particles, yielding a smooth surface with a roughness of nm dimensions. With the recently achieved high spatial resolution of the EBSD technique, the individual grain orientations in such samples can be determined for the first time. The EBSD results reveal a fibre-texture of the electroplated Py.

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MM 18.3 Tue 11:00 H 0107

Misorientations in magnetite thin films studied by electron backscatter diffraction — Anjela Koblischka-Veneva[1], •Michael R. Koblischka[2], Sunil Arora[3], Shane Murphy[3], Frank Mücklich[1], Uwe Hartmann[2], and Igor Shvets[3] — [1]Institute of Functional Materials, Saarland University, P.O.Box 151150, — [2]Institute of Experimental Physics, Saarland University, P.O.Box 151150, — [3]SFI Nanoscience Laboratory, Trinity College, Dublin, Dublin 2, Ireland

Magnetite thin films grown on [0 0 1] oriented MgO substrates are analyzed by means of electron backscatter diffraction (EBSD) analysis. Upon annealing in air, the magnetic properties of the magnetite thin films were found to change considerably. Using EBSD analysis, we find that after 3 minutes annealing, most of the misorientations around 30°-40° are vanished, and some areas with high misorientation angles more than 45° remain. These misoriented grains form small islands with a size of about 100 nm. The size and distribution of these islands correspond well to the observations of antiferromagnetic pinning centers in the magnetic domain structures carried out by magnetic force microscopy (MFM) on the same samples. EBSD can recognize maghemite particles embedded within the magnetite matrix. The detected maghemite particles (4 % of the total) are found to be very small (˜50 * 100 nm in diameter), but also clusters of them are detected. It is important to note that their presence is also causing misorientations within the magnetite matrix. The quality of such multi-phase EBSD analysis is discussed in detail.