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Magnetic domains in CrO_2 microstructures — •Alexander Biehler[1], Mathias Kläui[1], Mikhail Fonin[1], Christian König[2], Markus Laufenberg[1], Wolfgang Bührer[1], Gernot Güntherodt[2], and Ulrich Rüdiger[1] — [1]Fachbereich Physik; Universität Konstanz; 78457 Konstanz — [2]2. Physikalisches Institut; RWTH Aachen; 52056 Aachen

In half-metallic ferromagnetic materials, the majority-spin electrons exhibit metallic character while the minority-spin electrons show a semiconducting gap or vice versa, which leads to complete spin polarization at the Fermi level [1]. This class of materials is thus ideally suited for spin-polarized emitters in magnetic tunneling applications and for investigation of the interaction between highly spin-polarized currents and magnetic domain walls. We have probed the magnetization configuration in CrO_2 microstructures using magnetic force microscopy and have observed alternating domains with 180 degree domain walls in wires parallel to the magnetic hard axis. The magnetization switching and domain wall pinning at constrictions has been studied in wires along the easy axis. We have measured the magnetoresistance effects related to domain walls in these elements and have injected current pulses to study current-induced domain wall propagation due to the spin torque effect.

[1] Y. Dedkov et al., Appl. Phys. Lett. 80, 4181 (2002)

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Experimental realization of a model system for a two-dimensional two-phase magnet — •Sven Schnittger[1], Sebastian Dreyer[1], Christian Jooss[1], and Sibylle Sievers[2] — [1]Institut für Materialphysik, Universität Göttingen — [2]Physikalisch-Technische Bundesanstalt, Braunschweig

Two-phase magnets play an important role in the production of permanent magnet applications; especially the interplay of the different magnetostatic interactions is of great interest. In this contribution, the fabrication of a model system for a two-dimensional two-phase ferromagnet is presented. The sample consists of patterned hard magnetic structures ($L1_0$-CoPt) embedded in a soft magnetic film (Permalloy, $Fe_{19}Ni_{81}$). The size, the number and the distribution of the structures in the film as well as their spacing are varied. The fabrication process is done as follows: a magnetron-sputtered CoPt film on a (100)-MgO substrate is structured by electron beam lithography. The negative structure is etched into the film by reactive ion etching using an aluminum mask. The permalloy film is deposited by electron beam evaporation. The magnetic characterization is mainly accomplished by the magneto-optical indicator film technique using the Faraday Effect and by magnetic force microscopy. First results concerning the size-dependent remagnetization behaviour are presented.

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FePt nanoparticles from a Haberland type gas aggregation source: Morphological and structural characterization — •Franziska Schäffel, Elias Mohn, Thomas Gemming, Bernd Rellinghaus, and Ludwig Schultz — IFW Dresden, P.O. Box 270116, D-01171 Dresden

FePt nanoparticles are synthesized from a gas aggregation source of the type designed by H. Haberland [1]. The particles grow from a supersaturated metal vapor provided by sputtering from an alloy target at pressures of roughly p = 1 mbar. After nucleation and growth of the particles within an aggregation volume, they are ejected via ultrasonic expansion through an orifice into high vacuum (10^{-4}mbar $\geq$ p $\geq$ 10^{-5}mbar). As a consequence and in contrast to other gas phase techniques [2], further agglomeration of the particles is suppressed. Size fractionation of the particles can be obtained by using a quadrupole mass spectrometer for masses as high as 4×10^6 amu [3]. The morphology and crystal structure of the particles were investigated by means of conventional and high resolution transmission electron microscopy. The effect of the gas pressure in the aggregation chamber, the aggregation volume, the gas type, the orifice size, and the sputtering power on particle size, particle morphology, and particle size distribution was investigated. The system parameters were optimized to obtain non-agglomerated particles with diameters of $d_P \simeq 5$ nm, spherical morphology, and a narrow particle size distribution.

[1] "NC200U Nanocluster source application note", Oxford Applied Research Ltd., UK. [2] S. Stappert et al., J. Cryst. Growth 252 (2003) 440. [3] S.H. Baker et al., Rev. Sci. Inst. 68 (1997) 1853.

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Micromagnetic structures of nanocrystalline ferromagnets - comparison of experiment and simulation — •Srinivasa Rao Saranu[1], Andreas Grob[1], Ulrich Herr[1], and Jörg Weissmüller[2] — [1]Werkstoffe der Elektrotechnik, Universität Ulm, Ulm, Germany — [2]Institut für Nanotechnologie, Forschungszentrum Karlsruhe, Karlsruhe, Germany

Bulk nanocrystalline ferromagnetic materials show both hard and soft magnetic behavior depending upon the grain size and exchange length of the magnetic material. Small Angle Neutron Scattering (SANS) experiments show that the local orientation of magnetization averages over many grains at remnant state, whereas some magnetic fluctuations from applied field direction exists even at high external magnetic field. Micromagnetic simulations using the OOMMF code have been done to better understand the experimental results. Irregular random anisotropy nanocrystalline model systems with average grain size of 10 to 100 nm have been generated using a Voronoi construction. The total simulated cell size is 300x300x100 nm. In order to represent bulk nanocrystalline materials, we included anisotropy and exchange energy contributions whereas demagnetizing field energy contributions have been neglected. Magnetic microstructures of the model systems have been investigated at different applied fields and in the remnant state. Correlations of the spatial variations of magnetic moments at different applied magnetic fields were analysed by Fourier transformation. The simulated power spectra agree well with the SANS experimental results. This work has been supported by the Landesstiftung Baden-Württemberg.

MA 20.88 Tue 15:15 P1

Collective behavior of artificial magnetic dipoles — •Alexandra Schumann[1], Arndt Remhof[1], Andreas Westphalen[1], Thorsten Last[2], Ulrich Kunze[2], and Hartmut Zabel[1] — [1]Institut für Experimentalphysik/Festkörperphysik, Ruhr-Universität Bochum — [2]Lehrstuhl für Werkstoffe und Nanoelektronik, Ruhr-Universität Bochum

We have studied the remanent state and the remagnetization behavior of periodic arrays of rectangular shaped Py magnetic dipoles ($Ni_{80}Fe_{20}$, 0.3μm$\times 3\mu$m$\times$30nm) arranged in an open window type structure. The magnetic islands were prepared by e-beam lithography and ion-beam etching. The magnetic hysteresis was analyzed by vector MOKE and SQUID magnetometry. Images of the domain structure in remanence were taken by MFM. The open window like dipole array is a frustrated system, and several ground states can be realized, such as the onion-state, the horseshoe-state and the vortex state. The aim of the present work was to analyze the stability of each of the states as a function of field direction and gap size between the dipoles. Furthermore, we have studied the long range order of the magnetic dipole arrangement via Bragg-MOKE.

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Tailoring the domain structure in magnetic multilayers. — •Denis Korolkov[1], Emmanuel Kentzinger[1], Lutz Willner[1], Ralf Lehmann[2], Andre van der Hart[2], and Thomas Brückel[1] — [1]Forschungszentrum Jülich GmbH, Institut für Festköperforschung, D-52425, Jülich — [2]Forschungszentrum Jülich GmbH, Institut für Schichten und Grenzfläschen, D-52425, Jülich

Epitaxially grown Fe/Cr/Fe layered structures are known to exhibit the giant magnetoresistance effect. Magnetoresistance effects have attracted great interest due to their applications, for example, in magnetic random access memory. Due to the necessary miniaturization of such a device, the magnetic interaction between the neighbouring cells is becoming a more and more important parameter that has to be controlled [1].

Here we report on the preparation of lateral nanostructures on top of Fe/Cr multilayers. Self organization of diblock-copolymers with different ratios of molecular weights of the chains has been employed as "bottom-up" technique [2]. Electron-beam lithography with ion-beam etching has been used as "top-down" approach. We could produce nanostructures with a periodicity smaller than 50 nm on a large surface area.

The nanostructures were made visible with the surface sensitive technique of atomic force microscopy (AFM).

For the depth-resolved investigation of the lateral structure we used grazing incidence small angle neutron scattering GISANS.

[1] N. Ziegenhagen, U. Rücker, E. Kentzinger, R. Lehmann, A. van der Hart, B. Toperverg, Th. Brückel Physica B 335 (2003) 50-53 [2] I. W.