MA 7.7 Mon 16:30 HSZ 03

Intergrain interactions in nanocomposite Fe-Pt alloys — •Julia Lyubina, Kirill Khlopkov, Oliver Gutfleisch, Karl-Hartmut Müller, and Ludwig Schultz — IFW Dresden, Institute for Metallic Materials, P.O. Box 270016, D-01171 Dresden, Germany

The structure and magnetic properties of nanocomposite $Fe_{100-x}Pt_x$ (x=40-60) powders prepared by mechanical alloying followed by annealing are investigated. Different microstuctures were obtained depending on the Pt concentration: a combination of the hard magnetic $L1_0$ FePt and paramagnetic $L1_2$ $FePt_3$ phases, essentially single phase $L1_0$ FePt and a mixture of $L1_0$ FePt and soft magnetic $L1_2$ Fe_3Pt phases. For ferromagnetic phases, a domain structure comprised of elongated interaction domains was observed by magnetic force microscopy (MFM). MFM data and remanence curves were used to provide insight into the nature of intergrain interactions in such powders. The analysis points to strong intergrain coupling in the $Fe_{100-x}Pt_x$ powders. An additional small magnetostatic contribution can be observed for the Pt-rich powders.

MA 7.8 Mon 16:45 HSZ 03

Neutron scattering and modeling of dipole-field-induced spin disorder in Nanoperm — •Andreas Michels[1], C. Vecchini[2], O. Moze[2], K. Suzuki[3], P.K. Pranzas[4], J. M. Cadogan[5], and J. Weissmüller[6] — [1]Technische Physik, Universität des Saarlandes, Saarbrücken, Germany — [2]Physics Department, University of Modena and Reggio Emilia, Italy — [3]Department of Materials Engineering, Monash University, Melbourne, Australia — [4]GKSS Research Center, Geesthacht, Germany — [5]School of Physics, University of New South Wales, Sydney, Australia — [6]Institut für Nanotechnologie, Forschungszentrum Karlsruhe, Karlsruhe, Germany

We present temperature and magnetic-field-dependent small-angle neutron scattering data for the ferromagnetic nanocomposite Nanoperm ($Fe_{89}Zr_7B_3Cu_1$). The spin-misalignment scattering in the approach-to-saturation regime unexpectedly reveals pronounced lobes of high intensity at angles $\pm 30-40^\circ$ relative to the magnetic-field axis. Based on numerical calulations, the four-fold angular symmetry of the scattering pattern can be explained in terms of local spin misalignment, which originates from dipolar stray fields due to the mismatch of the saturation-magnetization values between the bcc Fe particles and the amorphous magnetic matrix.

[1] A. Michels *et al.*, Europhys. Lett. **72**, 249 (2005).
[2] C. Vecchini *et al.*, Appl. Phys. Lett., in press (2005).

MA 7.9 Mon 17:00 HSZ 03

Preparation of single-crystalline Fe nanopillars for Spin-Transfer Switching — •Henning Dassow, R. Lehndorff, D. E. Bürgler, M. Buchmeier, P. Grünberg, and C. M. Schneider — Institut für Festkörperforschung, Forschungszentrum Jülich GmbH, 52425 Jülich, Germany

We report on the preparation of single-crystalline Fe nanopillars and on the first measurements of spin-transfer effects in this system. By using molecular beam epitaxy, we first deposit a layered magnetic system containing three Fe layers on top of a thick Ag buffer layer: Ag(150)/Fe(14)/Cr(0.9)/Fe(10)/Ag(6)/Fe(2) [thicknesses in nm]. The measurement of the Magneto Optical Kerr Effect (MOKE) yields the magnetic properties of the samples. In various cleanroom steps we fabricate nanopillars of a diameter of 150 nm by a combined optical / e-beam lithography technique in which the pillars are defined by Ion Beam Etching (IBE). Redeposition of etched material is observed with Atomic Force Microscopy (AFM) and can significantly broaden the structure. After planarization we open the isolation and contact the top of the nanopillar with lift-off of Au. The effect of dipolar stray fields can be estimated by comparison of the Giant Magneto Resistance (CPP-GMR) and MOKE hysteresis loops. The stray fields also have direct influence on the spin-transfer switching of the nanopillars which is observed at current densities of $j \sim 2 \cdot 10^7$ A/cm^2 and can increase the critical current density by a factor of 10.

MA 7.10 Mon 17:15 HSZ 03

In flight optical heating of FePt nanoparticles — •Elias Mohn, Franziska Schäffel, Christine Mickel, Bernd Rellinghaus, and Ludwig Schultz — IFW Dresden, P.O. Box 270116, D-01171 Dresden

Monodisperse fractions of FePt nanoparticles are prepared by DC magnetron sputtering in an inert gas atmosphere at elevated gas pressures. Subsequent ejection into high vacuum results in an increase of the mean free path of the particles and thereby allows to substantially suppress inter-particle coalescence and sintering. In order to benefit from the high magnetic anisotropy of $L1_0$ ordered FePt without sacrificing monodispersity, the particles are to be subjected to in-flight thermal annealing prior to their deposition to establish the chemically ordered tetragonal phase. Since convective in-flight heating [1] is no longer efficient in high vacuum, optical heating is applied. We have therefore developed a UHV compatible light furnace, in which the light of 3 halogen lamps (with a power of up to 1.2 kW each) is focussed on the particles' flight path at a length of 150 mm. The crystal structure of the particles is characterized by means of TEM. The status quo of these experiments is reported. First investigations reveal the occurrence of recrystallization twins in the particles upon switching on the light furnace. This indicates an effective heat transfer from the electromagnetic field to the particles. The experimental results are corroborated by model calculations of the energy transfer based on classical electrodynamics. The dependence of the heating rate on the particle size is discussed.

[1] S. Stappert et al., J. Cryst. Growth 252 (2003) 440-450.

MA 7.11 Mon 17:30 HSZ 03

Arrays of magnetic nano particles using self-organised semiconductor surfaces — •Nikolai Mikuszeit[1], Miguel Angel Niño[1], Julio Camarero[1], Juan José de Miguel[1], Rodolfo Miranda[1], Christian Hofer[2], Christian Teichert[2], Thomas Bobek[3], and Stepan Kyrsta[4] — [1]Dpto. Física de la Materia Condensada, Universidad Autónoma de Madrid, E-28049 Madrid, Spain — [2]Institut für Physik, Montanuniversität, A-8700 Leoben, Austria — [3]Institut für Halbleitertechnik, RWTH-IHT, D-52056 Aachen, Germany — [4]Lehrstuhl für Werkstoffchemie, RWTH-MCh, D-52056 Aachen, Germany

The self-organisation of semiconductor surfaces has been used to create arrays of magnetic nano particles [1]. The surface structure and magnetic properties are amongst others investigated by AFM and MOKE. In a first approach we use strain induced self-assembled SiGe surfaces as growth templates. Shadow deposition onto these surfaces results in elongated magnetic dots [2]. In a second approach the formation of self-organised hexagonal dots of GaSb surfaces, due to Ar^+ sputtering, are used [3]. Deep trenches between the dots cut an embedded magnetic layer into discs. Both systems show dipolar coupling between the dots. To overcome the dipolar coupling a high magnetic anisotropy energy is required. In order to enhance the magnetic anisotropy, CoPt-multilayers with perpendicular anisotropy and Co/CoO in-plane systems are studied. The dot magnetic behaviour is compared to micromagnetic simulations.

[1] C. Teichert Appl. Phys. A **76**, 653 (2003)
[2] A. M. Mulders et al. Phys. Rev. B , **71**, 214422 (2005)
[3] S. Facsko et al. Science **285**, 1551 (1999)

MA 7.12 Mon 17:45 HSZ 03

Magnetic nanostructures produced by micelle masks — •S. Pütter[1], H. Stillrich[1], A. Frömsdorf[2], C. Menk[1], R. Frömter[1], S. Förster[2], and H. P. Oepen[1] — [1]Institut für Angewandte Physik, Jungiusstr. 11, 20355 Hamburg — [2]Institut für Physikalische Chemie, Grindelallee 117, 20146 Hamburg

The production of magnetic nanostructure arrays on the length scale of centimeters is a challenge of today's research. Usually, lithography is used though it is very time consuming. We follow an alternative way by utilizing self organized micelle patterns as masks. The micelles consist of diblock copolymers and can be produced in the diameter range from 20 nm to 100 nm. By dip coating single layers of micelles are deposited onto the substrates. The micelles form an almost hexagonal array with height modulation smaller than the micelle diameter.

Various ways to produce nanostructures are possible and applied. The growth of magnetic films on top of the micelles preserves the morphology. By sputtering the sample at grazing incidence the caps of the micelles are taken off and an antidot array is produced. An alternative way is to use filled micelles (e.g. with SiO_2). These micelles are deposited onto magnetic films. Sputtering at normal incidence produces a dot array due to different sputtering yields.

We have investigated the morphology and topography of the nanostructure arrays by SEM and AFM. We correlate the results of the afore mentioned studies with the magnetic behaviour obtained via magneto optical Kerr effect as well as scanning electron microscopy with polarization analysis.