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Several fundamentally and technologically interesting physical effects emerge when spin polarized currents in a ferromagnet pass through a laterally confined domain wall. We pursue different approaches for the fabrication of suitable structures for domain wall pinning which are based upon direct FIB (Focused Ion Beam) structuring. Our FIB is operating under ultrahigh vacuum condition. While the lateral resolution for imaging is 6 nm, the smallest structures written so far are 20nm. First results on 70 nm wide constrictions in a current in plane (CIP) geometry are presented. The experiments have been performed in a homogenous external field. Specifically shaped magnetic pads are used as a spin reservoir for injection. In 3 nm Ta / 8 nm NiFe / 3 nm Ta multilayers characteristic jumps in the magneto resistance (MR) are found which indicate the controlled injection of a domain wall into the constriction. We have also investigated the magneto resistance in a current perpendicular to plane (CPP) geometry. A cobalt point contact (smaller than 30 nm) has been fabricated by filling a pinhole milled into a silicon-nitride membrane. Financial support by the EU via EU04-586 "BMR" is gratefully acknowledged.

MA 12.7 Tue 11:45 H22

Current induced domain wall motion and domain wall transformations observed with XMCDPEEM — •Lutz Heyne, Dirk Backes, Markus Laufenberg, Mathias Kläui, and Ulrich Rüdiger — Universität Konstanz, 78457 Konstanz

While current-induced domain wall motion (CIDM) has been known theoretically [1] as well as experimentally, only recently controlled current-induced motion of single domain walls has been observed.

In this work we investigate CIDM in zig-zag permalloy wires of different dimensions. To image the magnetization configuration, x-ray magnetic circular dichroism photoemission electron microscopy (XMCDPEEM) is used. By imaging the magnetization contribution we can estimate an average domain wall (DW) velocity and directly observe spin-torque induced transformations of the internal DW structure.

In thick wires we observe a spin-torque induced nucleation and annihilation of magnetic vortices. The velocity is found to be directly correlated to these transformations [2]. Depending on the wire dimensions, several DW configurations are stable. A periodic transformation of the DW under current from vortex to transverse and vice versa is predicted by theory [3]. In a wire where both configurations can coexist we succeeded to image different DW configurations after the current pulses in agreement with theory, we also saw intermediate states, showing the actual transformation from transverse to vortex walls.

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MA 12.8 Tue 12:00 H22

Epitaxial $Co_2Cr_{0.6}Fe_{0.4}Al$ thin films and magnetic tunneling junctions — •Andres Conca, Martin Jourdan, Christian Herbort, and Hermann Adrian — Institut für Physik, Johannes Gutenberg University, Staudinger Weg 7, 55128 Mainz, Germany

The full-Heusler compound $Co_2Cr_{0.6}Fe_{0.4}Al$ (CCFA) is expected to be a half metal, i.e. to show a 100% spin polarization at the Fermi energy. This property, together with the relatively high Curie temperature (800K) and the soft magnetic behaviour make CCFA a promising candidate for implementation in spinelectronic devices.

Magnetic tunneling junctions were deposited using epitaxial CCFA thin films as ground electrode with AlOx as barrier and Co as counter electrode. The use of an Fe buffer layer on MgO(100) induces the growth of highly ordered CCFA films with smooth surface even at low deposition temperatures, as proved by XRD, TEM and in-situ STM investigations. The CCFA films were additionally annealed at different temperatures up to 600°C. The dependence of the TMR ratio on the annealing temperature was studied. A maximum TMR ratio of 40.5% was measured from which a spin polarization of 54% is deduced by the Jullière model. Possible correlations between the TMR ratio and the surface properties, as observed with STM and RHEED, are discussed.

Alternatively, epitaxial CCFA films were also grown directly on $MgAl_2O_4(100)$ and $Al_2O_3(110)$. A comparison with the results on MgO substrates is shown.

MA 12.9 Tue 12:15 H22

Inverted spin polarization of Heusler alloys — •Andy Thomas[1], Dirk Meyners[1], Daniel Ebke[1], Ning-Ning Liu[1], Jan Schmalhorst[1], Guenter Reiss[1], and Andreas Huetten[1,2] — [1]Bielefeld University, Thin films and nanostructures, Germany — [2]Research Center Karlsruhe, Institute for Nano-technology, Germany

We prepared magnetic tunnel junctions with different Heusler compound electrodes and investigated the transport properties of these devices. The most striking feature of these structures is the inversion of the tunnel magnetoresistance (TMR) effect at certain bias voltages.

We use this feature to present a magnetic logic concept that overcomes the limitations of field programmable logic arrays while having a 50% smaller unit cell then conventional TMR designs. To reach that the negative TMR effect is used as an additional degree of freedom. This might be possible in other spintronic devices.

Band structure calculations give the theoretic explanation of the negative TMR.

MA 12.10 Tue 12:30 H22

On the asymmetry of the inelastic tunneling spectra on magnetic materials — •Albert F. Takács[1], Timofey Balashov[1,2], Wulf Wulfhekel[1,2], Jürgen Kirschner[2], Markus Däne[3], Arthur Ernst[2], and Patrick Bruno[2] — [1]Physikalisches Institut, Universität Kalrsuhe (TH), Wolfgang-Gaede Str. 1, 76131 Karlsruhe — [2]MPI für Mikrostrukturphysik, Weinberg 2, 06108 Halle — [3]Martin-Luther-Universität Halle-Wittenberg, Fachbereich Physik, 06099 Halle

Inelastic tunneling spectroscopy (ITS) is a valuable tool to study excitations in metallic systems. We have applied ITS to investigate low lying magnetic excitations. For tunneling between a non-magnetic tip and a ferromagnet, the excitations were found to be asymmetric with respect to the Fermi energy.

For Fe(001) magnon creation was found predominantly for tunneling into the ferromagnet, while for opposite bias the excitation is much weaker. For fcc Co(001) strong magnon excitations were found for both positive and negative bias. Using *ab-initio* calculations of the spin-polarised DOS of the ferromagnets we show that this asymmetry is related to the spin-polarisation of the ferromagnet. This effect has strong implications for the efficiency of the spin transfer effect used in switching of MRAM cells.

MA 12.11 Tue 12:45 H22

Magneto-transport hysteresis loop of a single nanostructure — •Guillemin Rodary, Sebastian Wedekind, Dirk Sander, and Jürgen Kirschner — Max-Planck-Institut für Mikrostrukturphysik, Weinberg 2, D-06120, Halle (Saale), Germany

We have studied morphological, electronic and magnetic properties of a single cobalt nano-island by means of spin-dependent scanning tunneling microscopy (SP-STM) at 7K and under a high magnetic field (7T). Two monolayer high triangular Co islands are grown on Cu(111) surface at room temperature and are then imaged by STM at low temperature. Scanning tunneling spectroscopy reveals spin polarized states of the nano-islands [1]. In contrast to previous studies using the field variation of images contrast to obtain a magnetic hysteresis loop [2], we directly record the apparent topology change with magnetic field variation at a single point. This method allows to understand the magnetic properties of a single nano-object, as the coercitive field or the switching behavior. The magneto-transport hysteresis curve obtained is explained from a tunnel magnetoresitance standpoint. We discuss the precise method to obtain such measurement with a STM in comparison to solid state spin electronic experiments, specially artifacts that have been isolated.

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