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Magnetoresistance behavior of Co nanowires with constrictions
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We investigate spin transport through a domain wall confined in a nanoconstriction and ballistic spin transport in ferromagnetic crossbar configurations. For this, resistance measurments are performed on polycrystalline cobalt nanowires which are prepared by means of high resolution electron beam lithography (HR-EBL). Constrictions with critical dimensions of the order of 10 nm are prepared at the junction of T-shaped Co nanowires. In order to prevent oxidation some of the Co nanowires are covered *in situ* with a 2 nm Pt layer or a 10 nm carbon layer. By annealing, the mean grain size of the nanowires has been varied in the range of approximately 7 to 35 nm. The magnetic properties are investigated by magnetic force microscopy (MFM). Due to the shape anisotropy the two sides of the nanocontact respond in different ways to an applied magnetic field. Magnetoresistance measurements were carried out via a four-terminal ac resistance bridge in a ^{4}He bath cryostat at a temperature of $T = 4.2$ K. Magnetic fields up to $B = 5$ T were applied along different in-plane directions. Furthermore, the ballistic transport is investigated by nonlocal resistance measurements.

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Heusler alloy based magnetic tunnel junctions with MgO barrier
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Half-metallic Heusler alloys are expected to be promising candidates for ferromagnetic electrode materials in magnetic tunnel junctions. In this work MTJs with the stack structure $Ta/Co_2Cr_{0.6}Fe_{0.4}Al/MgO_x/CoFe/$ IrMn/Ta/Cu/Au were magnetron sputtered on thermally oxidized Si. The MgO_x tunnel barrier was prepared by oxidizing a Mg film using a rf wave resonance plasma beam source as well as by rf sputtering from a MgO target in an Ar/O_2-mixture. The obtained junction properties (junction resistance, magnetorestistance ratio, switching characteristics) are discussed in dependence on the preparation conditions of the Heusler electrode and the tunnel barrier, on the barrier thickness and on the annealing temperature.

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Interface properties of the half-metallic Co_2MnSi
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Halfmetallic ferromagnets are promising candidates as electrode material in magnetic tunnel junctions (MTJ). Because of their predicted spin-polarization of 100% one expects high tunnel magneto resistance (TMR) effects. With the Heusler alloy Co_2MnSi a TMR of currently 108% at 20K has been reached. This leads to a spinpolarization of 70%. The high TMR value strongly depends on the oxidation parameters of the adjacent alumina layer and the annealing temperature of the Co_2MnSi. Two mechanisms can explain this behavior. On the one hand there is found a Mn and Si diffusion to the electrode/ barrier interface and on the other hand a formation of MnO at the interface. We have investigated the stoichiometry and the element specific magnetization at the Co_2MnSi/ barrier interface with X-Ray absorption spectroscopy (XAS) and the magnetic circular dichroism (XMCD). We introduced thin interlayer (Co, Mn or Si) with varying thickness between the Heusler alloy and the tunnel barrier. Thus we can investigate in detail the influence of the three materials on the TMR as well as on the magnetic moment and the stoichiometry.

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Magnetoresistance of tunnel junctions with electrodes of the Heusler compounds Co_2MnGe and Co_2MnSn
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Heusler compounds with predicted 100% spin polarization at the Fermi level are materials of great potential in the field of spintronics. We have fabricated magnetic tunnel junction using the fully spin polarized Heusler compounds Co_2MnGe and Co_2MnSn as the bottom electrode and Co as the counter electrode. The films are patterned using shadow mask technique and the Al_2O_3 tunnel barrier is prepared by plasma oxidation of a thin Al layer. The tunnel magnetoresistance which we determine at low temperatures is 27% maximum, corresponding to a spin polarization much lower than the theoretically predicted 100%. We discuss the origin of the loss of full spin polarization, which could be caused by some oxidation of the Heusler surface at the Heusler/barrier interface, or the loss of half metallicity for a surface layer of the Heusler compound due to by site disorder or interdiffusion.

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Strong temperature dependence of antiferromagnetic coupling in CoFeB/Ru/CoFeB
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Due to their high tunneling magnetoresistance (TMR) of up to 70%, magnetic tunnel junctions (MTJ) with electrodes consisting of amorphous $Co_{60}Fe_{20}B_{20}$ have gained considerable interest for the use in applications, e.g. sensor applications or magnetoresistive random access memories (MRAM).

Furthermore it has been shown, that artificial ferrimagnets (AFi), consisting of two antiferromagnetically coupled layers of amorphous CoFeB separated by a thin nonmagnetic Ru-spacer, exhibit a stable coupling and a significant lower coercivity than AFi systems of polycrystalline CoFe materials.[1] Due to their magnetic properties, they are promising candidates also for the use as soft magnetic electrode in MTJs.[2]

Here we present the temperature dependence of saturation field (coupling) in dependence of Ru spacer thickness and net moment of the AFi. In good accordance to the theory, the investigated samples show a strong temperature behavior $\sim \frac{T/T_0}{\sinh(T/T_0)}$, where $T_0 = \frac{\hbar v_F}{2\pi k_B t_{Ru}}$. The Fermi velocity, v_F, evaluated for the investigated samples within this model, turns out to be in the order of 10^7cm/s.

[1] N. Wiese et al., J. Magn. Magn. Mater. 290-291, 1427 (2005)
[2] N. Wiese et al., accepted for publication in J. Appl. Phys. (2005)

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Angular dependence of Magnetization Reversal In Exchange Biased Multilayers
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Recently we observed sequential and symmetric magnetization reversal of the ferromagnet (FM) layers by domain wall motion for exchange coupled FM and antiferromagnetic (AF) multilayer systems such as [IrMn/CoFe]_10 [1] and [Co/CoO]_20. This symmetric reversal on both branches of the hysteresis loop without the usually observed magnetization component perpendicular to the applied field - follows the theoretical speculation of an alignment of the field-cooling axis (H_{FC}) with the applied field axis (H_a) by Beckmann et al [2]. In the present case, we investigate the same polycrystalline IrMn/CoFe sample measuring along each full magnetization loop: increasing (H_a along H_{FC}) and decreasing (H_a opposite H_{FC}), by specular and off-specular Polarized Neutron scattering as we vary the directions (theta) of the H_a with respect to the unidirectional anisotropy direction or the H_{FC} direction. Depending upon theta, the remagnetization behavior of all FM layers takes place sequentially which is either by nonuniform mode (via domain formation) or uniform mode (via coherent rotation) and also simultaneously which is by uniform mode only. [1] A. Paul et al., Phys. Rev. B 70, 224410 (2004). [2] B. Beckmann et al., Phys. Rev. Lett. 91, 187201 (2003).

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Thermal stability of three dimensional structured exchange bias systems with ion bombardment induced magnetic patterning
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The magnitude as well as the direction of the exchange bias effect in ferromagnet/antiferromagnet layer systems can be manipulated by He-