MA 6: Magnetic Thin Films I (Heusler Alloys)

Time: Monday 14:00–19:00 Location: H10

Invited Talk MA 6.1 Mon 14:00 H10

Heusler alloy films for spintronics — •Terunobu Miyazaki[1], Daisuke Watanabe[1], Shigemi Mizukami[1], Feng Wu[1], Takahide Kubota[2], Sumito Tsunegi[2], Hiroshi Nagahama[2], Mikihiko Oogane[2], and Yasuo Ando[2] — [1]WPI Advanced Institute for Materials Research Tohoku Univ. Sendai Japan — [2]Department of Applied Physics Tohoku Univ. Sendai Japan

Half-metallic ferromagnets are an ideal material for obtaining high tunnel magnetoresistance (TMR) ratio because they have an energy gap at the Fermi level only in the up or down spin channel. Especially, Heusler alloys show a high Curie temperature and relatively high value of saturation magnetization and they are expected as an ideal material for spintronics. However, the realization of high TMR ratio and high spin polarization experimentally shown is in recent years. In my talk, first historical study of Heusler electrode tunnel junction including our past data will be explained. Then, transport properties of Co2FexMn1-xSi/Al-O/Co75Fe25 tunnel junctions and Gilbert damping constant in Co2FexMn1-xSi films for x of 0-1.0 will be explained in detail. Finally, I will explain an experiment for epitaxial Mn2.5Ga films, which are tetragonal (non-cubic Heusler type alloy) and exhibit perpendicular magnetic anisotropy of the order 107 erg/cc and low saturation magnetization about 250 Gauss. One can expect for the MnGa film as one candidate for the electrode material of MTJ of Spin-RAM. A quite recent experiments related to memory materials will be also included.

Invited Talk MA 6.2 Mon 14:30 H10

Heusler alloy based magnetic read heads — •Stefan Maat — Hitachi, 5601 Great Oaks Parkway, San Jose, CA 95119 (USA)

All-metal current perpendicular-to-the-plane giant magneto-resistive sensors are an attractive follow-on reader technology to tunnel-magneto-resistance sensors as magnetic recording densities continue to increase. With low resistance-area products in the range 0.05 Ohm*um2, CPP-GMR sensors exhibit low impedance and therefore low noise even at sensor dimensions below 30 nm. Although the magneto-resistance (dR/R) of CPP-GMR sensors increases with thicker magnetic layers due to spin-diffusion length effects their thickness is limited by the desired shield-to-shield spacing determining the maximum linear recording density. Among the challenges that CPP-GMR sensors face are low dR/R for thin magnetic layers as well as current-induced noise and magnetic instability from spin-torque effects, which arise from the interaction of spin-polarized electron current with the magnetization of the electrodes. Highly spin-polarized Heusler based alloys are promising candidates to achieve high dR/R. However, these alloys are challenging to synthesize with full order in a thin film form within the low growth and annealing temperature limitations. Although film-level dR/R of ~ 8 % has been obtained in spin-valves with CoFeGe and Co2MnGe electrodes (compared to 2% with CoFe), these alloys give rise to a high level of spin-torque excitation due to their high spin-polarization and low magnetic damping resulting in sensor noise. Thus, new multilayer structures to suppress excessive spin-torque excitations need to be implemented.

MA 6.3 Mon 15:00 H10

Wachstum und Charakterisierung ferromagnetischer Co_2FeSi-Filme auf Galliumarsenid(110)-Substraten — •Thomas Hentschel, Claudia Herrmann, Hans-Peter Schönherr, Bernd Jenichen und Jens Herfort — Paul-Drude-Institut für Festkörperelektronik, Hausvogteiplatz 5-7, 10117 Berlin

Die ferromagnetische Heusler-Legierung Co_2FeSi gilt aufgrund der theoretisch vorhergesagten hohen Spinpolarisation (bis zu 100%) und der hohen Curie-Temperatur (>980 K) als vielversprechendes Material zur Realisierung spinpolarisierter Elektroneninjektion in einen Halbleiter. Von besonderem Interesse ist das Wachstum von Co_2FeSi auf der GaAs(110) Oberfläche, da hier theoretischen Berechnungen zufolge im Gegensatz zur (001)-Orientierung die hohe Spinpolarisation an der Ferromagnet/Halbleiter-Grenzfläche erhalten bleibt und eine deutlich längere Spinlebensdauer im Halbleiter zu erwarten ist. In unserer Arbeit wurden 15 bis 40 nm dicke stöchiometrische Co_2FeSi-Filme auf GaAs(110) mittels Molekularstrahlepitaxie gewachsen. Rasterkraftmikroskopie-Aufnahmen zeigen bei Wachstumstemperaturen zwischen T_G=100 °C und 225 °C ausgeprägte Stufen und Terrassen, was auf zweidimensionales Wachstum schließen lässt. Röntgenbeugungsexperimente an (220)- und (440)-Reflexen zeigen bis etwa 250 °C neben dem Substrat- und Schichtpeak ausgeprägte Oszillationen (Fringes), die auf eine atomar scharfe Grenzfläche hinweisen. Oberhalb von 250 °C setzen Grenzflächenreaktionen ein. Das Vorhandensein ordnungsabhängiger Reflexe bei $T_G \approx 200$ °C weist zudem auf eine geordnete $B2$- bzw. sogar $L2_1$-Struktur hin.

MA 6.4 Mon 15:15 H10

Thin films of the ferrimagnetic Heusler compound Mn_2VAl — •Arbelo Jorge Elena, Brose Daniel, Jourdan Martin, Klaer Peter, and Elmers Hans Joachim — Institute of Physics, Johannes-Gutenberg University, Staudinger Weg 7, 55099 Mainz, Germany

Half-metallic ferrimagnetic materials are interesting candidates for spintronic applications. In comparison with ferromagnetic compounds, their values of the total magnetic moments are small which provides additional benefits. They are less affected by an external magnetic field and do not cause strong stray fields in devices.

First experimental studies on thin films of the ferrimagnetic Heusler compound Mn_2VAl are presented here. The Heusler Mn_2VAl thin films are prepared by rf-sputtering on MgO substrates at room temperature followed by an annealing step. The crystallographic and magnetic properties are analysed by using X-ray diffraction, SQUID magnetometry and X-ray Magnetic Circular Dichroism (XMCD), respectively.

The structural analysis shows B2 order for films annealed at 550^oC. Concerning magnetic properties, first XMCD results at RT show a spin moment of 1.06 μ_B/f.u and -0.9 μ_B/f.u for Mn and V, respectively in the bulk and a reduction to 0.46 μ_B/f.u and -0.22 μ_B/f.u at the surface. The values in the bulk are in certain agreement with theoretical predictions which are 1.5 μ_B/f.u and -0.9 μ_B/f.u, giving rise to a total spin moment of -2 μ_B/f.u.

First results of this compound implemented in Magnetic Tunneling Junctions are shown.

MA 6.5 Mon 15:30 H10

Growth of epitaxial thin films of Co_2MnSi and Cu_2MnAl by solid-state crystallization from the x-ray amorphous state. — •Denise Erb, Gregor Nowak, Kurt Westerholt, and Hartmut Zabel — Ruhr-Universität Bochum

Ferromagnetic Heusler alloys have attracted considerable interest recently, since the full spin polarization at the Fermi level in some of these compounds makes them promising candidates for spintronic applications. Using UHV magnetron sputtering at room temperature and subsequent annealing we have prepared thin films of the Heusler phases Co_2MnSi and Cu_2MnAl on MgO (100) and Al_2O_3 (a-plane) substrates. The structural properties were studied by synchrotron-based x-ray diffraction; the magnetic properties were investigated by vibrating sample magnetometry. In the as-prepared state the films are atomically disordered and non-magnetic. Upon annealing ferromagnetism develops together with the crystalline structure. Co_2MnSi films grown on Al_2O_3 (a-plane) and different seedlayers exhibit only the (220) Bragg reflection, indicating a long-range order of the A2-type after annealing. However, the ferromagnetic quality of these samples evidences a short-range $L2_1$ order. Cu_2MnAl can be grown directly on MgO (100) with the in-plane [100]-direction rotated by 45° from the [100]-direction in MgO. The presence of the (111) Bragg reflection in Cu_2MnAl samples proves the epitaxial quality and a long-range $L2_1$ order in the annealed state.

MA 6.6 Mon 15:45 H10

Transport spin polarization of thin MBE-grown Co_2FeSi-films — •Hauke Lehmann[1], Jan M. Scholtyssek[1,2], Jens Herfort[3], Claudia Herrmann[3], Guido Meier[1], and Ulrich Merkt[1] — [1]Inst. f. Angew. Physik, Universität Hamburg, Jungiusstr. 11, 20355 Hamburg — [2]Inst. f. Elekt. Messtechnik und Grundlagen der Elektrotechnik, TU Braunschweig, Hans-Sommer-Str. 66, 38106 Braunschweig — [3]Paul-Drude-Institut f. Festkörperelektronik, Hausvogteiplatz 5-7, 10117 Berlin

The predicted half-metallicity of Co_2FeSi in combination with its high Curie temperature of above 980 K [1] makes this Heusler alloy very interesting for spintronic applications. Thin Co_2FeSi films grown by molecular-beam epitaxy are fabricated on GaAs substrates with a

close lattice match. We determine the transport spin polarization at the Fermi energy by point-contact Andreev-reflection (PCAR) spectroscopy. A systematic study of PCAR measurements on different films, varying in thickness between 18 and 48 nm and in substrate temperature at the deposition process between 100 and 350^{o}C is presented. The highest polarizations of about 60% can be observed for films grown at substrate temperatures of 200 to 300^{o}C. At higher temperatures Cobalt might diffuse into the substrate [2], leading to a decrease of the polarization. A repetition of the measurements on samples stored in vacuum and in air after one year also shows a measurable decrease of the spinpolarization, presumably caused by oxidation.

[1] V. Niculescu et al., J. Magn. Magn. Mater. **5**, 60 (1977)
[2] M. Hashimoto et al., J. Phys. D: Appl. Phys. **40**, 1631 (2007)

MA 6.7 Mon 16:00 H10

Thin magnetic films of the Heusler compound $Co_2FeAl_{0.4}Si_{0.6}$ — •Frederick Casper[1], Tanja Graf[1], Johannes Paul[2], Gerhard Jakob[3], and Claudia Felser[1] — [1]Institute of Inorganic and Analytical Chemistry, Johannes Gutenberg - University, 55099 Mainz, Germany — [2]SENSITEC GmbH, 55131 Mainz, Germany — [3]Institute of Physics, Johannes Gutenberg - University, 55099 Mainz, Germany

Half-metallic compounds which are fully spin polarized near the Fermi level (E_F) due to an energy gap in the minority-spin channel have attracted great attention as key materials for creating spintronic devices. Co-based Heusler compounds have been predicted to have a high spin polarization even at room temperature due to their high Curie temperature of around 1000 K. To overcome the problem of narrow energy separation between the Fermi level and the bottom edge of the conduction band, $Co_2FeAl_{1-X}Si_X$ (CFAS) has been predicted to be more stable against the influence of temperature. For X = 0.5, several reports show promising results with CFAS in magnetic tunnel junctions using MgO and Al_2O_3 as tunnel barrier. Here we show the first results of $Co_2FeAl_{0.4}Si_{0.6}$ films on MgO and SiO_X substrates. Depending on the annealing temperature, buffer layer and substrate, CFAS shows B2 and/ or $L2_1$ type of order. Magnetic moments ranging from 3.8 to 5.1 μ_B/f.u. depending on the degree of ordering. AFM measurements show smooth surfaces, and XPS reveal the right stoichiometry for all films. This work is supported by the Federal Ministry for Education and Research BMBF, project "'Multimag"'.

MA 6.8 Mon 16:15 H10

Fe-rich Heusler/semiconductor hybrid structures: An ab initio study of the electronic and magnetic structure of the interface — •Heike C. Herper and Peter Entel — Faculty of Physics, University of Duisburg-Essen, 47048 Duisburg, Germany

Ferromagnet(FM)-semiconductor(SC) hybrid structures have attracted much interest concerning the fabrication of spintronic devices. Fe and Co based Heusler alloys seem to be suitable for this purpose, because they are often half-metallic or have at least a high spin-polarization and a high T_C. Though, some of the stoichiometric systems have been intensively studied only few results exist for the nonstoichiometric systems and for the magnetic structure of the FM/SC interface. We focus on $Fe_2Fe_{1-x}Y_xSi$ (Y = Co, Ni) Heusler alloys. Fe_3Si and Fe_2CoSi are known to have high T_Cs and being close to half-metallicity. In agreement with experiment we observe that the replacement of Fe by Co or Ni leads to an inverse Heusler ordering instead of the $L2_1$ structure. However, it turns out that the magnetic properties are sensitive to strain which may occur at interfaces.

First, we investigate the dependence on the concentration x and the structural ordering for the bulk phases. In a second step we perform calculations for the Fe-rich Heuslers on GaAs(001) and MgO(001) to study the polarization, the band gap etc. We observe that the polarization not only increases but also layer dependent oscillations of the polarization are reduced if Co is added to the system. The calculations are performed by using the VASP [Mater. Sci.**6**,15 (1996)] and SPR-KKR [by H. Ebert et al.] code.

MA 6.9 Mon 16:30 H10

X-ray diffraction studies of Co_2MnSi and Co_2FeAl Heusler compounds in magnetic tunnel junctions — •Patrick Thomas, Daniel Ebke, Markus Schäfers, Oliver Schebaum, Andreas Hütten, and Andy Thomas — Thin Films and Physics of Nanostructures, Physics Department, Bielefeld University, Germany

Recently, we have shown high room temperature tunnel magnetoresistance values of about 150% for magnetic tunnel junctions containing the Heusler compound Co_2FeAl.

In this work, we will present the structural properties of the Co_2FeAl electrode that were determined by x-ray diffraction (XRD) as a function of annealing temperature. A B2 type structure can be achieved for all annealing temperatures. This is compared to (XRD) studies of similar layer stacks based on the Heusler compound Co_2MnSi.

It will be discussed if a Co_2FeAl buffer layer underneath another Heusler compound, e.g. Co_2MnSi can induce a lower crystallization temperature as it was previously reported for Co_2FeSi/Co_2MnSi multilayers.

MA 6.10 Mon 16:45 H10

Disorder-induced sign reversal of spin polarization in Co_2FeSi — •Pawel Bruski[1], Oliver Brandt[1], Steve Erwin[2], Rouin Farshchi[1], Klaus-Jürgen Friedland[1], Jens Herfort[1], and Manfred Ramsteiner[1] — [1]Paul-Drude-Institut für festkörperelektronik, 10117 Berlin — [2]Center for Computational Materials Science, Naval Research Laboratory, Washington, DC 20375, USA

The ferromagnetic Heusler alloy Co_2FeSi is closely lattice matched to GaAs and is predicted to be halfmetallic, meaning electrons at the Fermi level are 100% spin-polarized. We investigated spin light emitting GaAs/(Al,Ga)As diodes (spin-LEDs) with Co_2FeSi injection layers grown by molecular-beam epitaxy at different substrate temperatures T_S. An opposite sign of the electroluminescence polarization (ca. 20%), i.e., spin polarization of injected electrons has been observed for spin-LEDs grown at $T_S = 100$ °C and $T_S = 280$ °C, respectively. Previous structural studies revealed that the partially disordered $B2$ phase of Co_2FeSi dominates near the interface for lower T_S while the fully ordered $L2_1$ phase dominates for higher T_S. Consequently, the experimentally observed sign reversal is attributed to a different spin orientation dominating at the Fermi energy of the two different Co_2FeSi phases. This conclusion is supported by first-principles calculations of the density of states by the LDA+U method. For intermediate T_S, Co_2FeSi layers consist of a spatially inhomogeneous distribution of the $L2_1$ and the $B2$ phases compensating each other by the injection of oppositely spin-polarized electrons. Consequently, the corresponding spin-LEDs exhibit a comparatively small total spin-injection efficiency.

MA 6.11 Mon 17:00 H10

Determination of magneto-optical coupling constant of ferromagnetic metals — •Kahming Mok[1], Nan Du[1], Maciej Oskar Liedke[1], Shengqiang Zhou[1], Mathias Schubert[2], Manfred Helm[1], and Heidemarie Schmidt[1] — [1]Forschungszentrum Dresden Rossendorf, Dresden, Germany — [2]University of Nebraska-Lincoln, Nebraska, USA

Magneto-optical generalized ellipsometry (MOGE) is the most general approach to characterize the magneto-optical response of multilayer materials. One of the most basic mechanism in magneto optics is the spin nature of the electrons and the spin dependent selection rules. The characterization of magneto-optical materials typically requires 3 independent complex-valued parameters in its purely magneto-optical tensor description [1]. In our work, we measured the Mueller matrix of MBE grown ferromagnetic thin films (Co, Fe, Ni) using a variable angle spectroscopic ellipsometer (VASE) combined with a 3D 0.5 T vector magnet which can operate as a vector MOGE. We probed the Mueller matrix of reflected and transmitted light in the spectral range from 1 to 4 eV and modeled it by the 4 x 4 matrix method. From that we determined the complex magneto-optical coupling constants Q of Co, Fe, and Ni. [1] M. Schubert, "Infrared ellipsometry on semiconductor layer structures: Phonons, plasmons, and polaritons", Springer, Berlin, 2004.

15 min. break

MA 6.12 Mon 17:30 H10

Dependence of domain width on second order anisotropy — •D. Stickler[1], R. Frömter[1], H. Stillrich[1], C. Menk[1], C. Tieg[2], C. Gutt[3], S. Streit-Nierobisch[3], L.-M. Stadler[3], O. Leupold[3], G. Grübel[3], and H. P. Oepen[3] — [1]Institut für Angewandte Physik, Jungiusstr. 11, 20355 Hamburg — [2]Helmholtz-Zentrum Berlin für Materialien und Energie GmbH, Albert-Einstein-Str. 15, 12489 Berlin — [3]Deutsches Elektronen-Synchrotron (DESY), Notkestr. 85, 22607 Hamburg

The domain width of magnetic films with uniaxial perpendicular anisotropy is a consequence of the interplay between magnetostatic and domain wall energy. We fit the analytical solution for the magnetostatic energy of single layers[1] to numerical results for multilayers[2], with the thickness and scaling factor for the magneto-static energy

as fit parameters. With the achieved analytical description, we calculate the energy minimum as a function of domain width, by utilizing the domain wall energy expression for systems with considerable K_2-contribution[3]. The model is applied to our findings on soft x-ray Fourier transform holography of anisotropy modulated films of constant thickness[4]. The anisotropy was tuned via ion beam bombardment. The analysis reveals that close to reorientation K_2 determines the domain width, while changes in K_1 are responsible for the transitions of the magnetization from vertical to in-plane orientation.

[1]Kaplan and Gehring, JMMM**128**, 111 (1993) [2]Draaisma and de-Jonge, J.Appl.Phys.**62**, 3318 (1987) [3]Träuble et al., Phys.Stat.Sol.**10**, 283 (1965) [4]Streit-Nierobisch et al., J.Appl.Phys.**106**, 083909 (2009)

MA 6.13 Mon 17:45 H10

Interface properties of spin injection systems and tunnel barrier systems: Fe_3Si on GaAs(001) and MgO(001) — •Sergey Makarov, Frank Stromberg, Bernhard Krumme, Claudia Weis, Werner Keune, and Heiko Wende — Fakultät für Physik and CeNIDE, Universität Duisburg-Essen

For spintronic applications, not only the charge transfer to the semiconductor, but also the spins of the electrons are of interest. Ferromagnet/semiconductor interfaces allow controlling the spin orientation of injected electrons. The degree of spin polarisation depends on the structural quality of the interface. Furthermore, the spin injection efficiency can be improved by introducing a tunnel barrier at the interface.

The quasi-Heusler system Fe_3Si is a promising candidate for such applications. It grows well ordered on MgO(001) with a low lattice mismatch to semiconducting GaAs(001). We have investigated the chemical ordering of Fe_3Si by conversion electron Mössbauer spectroscopy (CEMS) using the ^{57}Fe tracer layer technique. From CEMS we obtain the long-range order parameters S($D0_3$) and S(B2) together with the Si concentration. Strong interdiffusion occurs at the Fe_3Si/GaAs interface. Introducing a MgO tunnel barrier hinders the interdiffusion. Fe_3Si/MgO/GaAs(001) suprisingly shows an almost ordered $D0_3$-structure with 26% Si-content. However, the $^{57}Fe_3Si$ tracer layer at the MgO-buffer layer displays the B2-ordered structure with randomly distributed Si atoms on Fe sites. On the MgO tunnel barrier, the chemical order of Fe_3Si is comparable to Fe_3Si grown directly on a MgO(001) single crystal. – Supported by the DFG (Sfb491).

MA 6.14 Mon 18:00 H10

Magnetic properties of PdFe alloys — •Melanie Ewerlin[1], Stefan Buschhorn[1], Bastian Pfau[2], Christian Günther[2], Stefan Heinze[2], Stefan Eisebitt[2], and Hartmut Zabel[1] — [1]Institut für Experimentalphysik IV, Ruhr-Universität Bochum, 44780 Bochum — [2]Helmholtz-Zentrum Berlin für Materialien und Energie GmbH, 14109 Berlin

We investigate the itinerant ferromagnetic system Pd1-xFex for different compositions with x=3.4-7.2. The Fe atoms provide a strong molecular field and trigger the alloy to a ferromagnetic state by polarization of the Pd atoms. This polarization effect is directly proven by x-ray magnetic circular dichroism experiments, which allow element specific magnetization measurements by resonantly tuning the x-ray energy. We are able to detect a clear magnetic dichroism signal both at the Fe L-edge and the Pd M-edge. Magnetic small angle x-ray scattering experiments at the Fe L-edge reveal a domain size of approximately 150nm in the samples. The shape of the hysteresis loops, magnetization curves and magnetization relaxation measurements measured with SQUID indicate the coexistence of long range ferromagnetism and also cluster magnetism in the alloy. Soft x-ray photon correlation spectroscopy measurements are performed to reveal both domain fluctuations and also possible spin fluctuations of Fe nanoclusters embedded in the Pd-matrix.

MA 6.15 Mon 18:15 H10

Hard X-ray photoelectron spectroscopy studies of buried magnetic multilayers at PETRA III. — •Andrei Gloskovskii[1], Gerhard H. Fecher[1], Claudia Felser[1], Sebastian Thiess[2], Heiko Schulz-Ritter[2], Wolfgang Drube[2], Götz Berner[3], Michael Sing[3], and Ralph Claessen[3] — [1]Institute of Inorganic and Analytical Chemistry, Johannes Gutenberg - University, Mainz — [2]Hasylab/DESY, Hamburg — [3]Experimental Physics 4, University of Würzburg, Würzburg

We report on the first hard X-Ray photoelectron spectroscopy (HAXPES) experiments at the undulator beamline P09 of the PETRA III storage ring, currently being commissioned at DESY in Hamburg. With the combination of high-flux undulator radiation from a brilliant third generation hard X-ray source and high-resolution electron spectrometers operating at high voltages (kinetic energies up to 15 keV) HAXPES becomes a powerful tool for the investigation of electronic and magnetic properties of bulk materials and buried layers. Here, the properties of several promising candidates for tunnel magnetoresistive devices were investigated. Pinned MnIr-CoFe thin film multilayers show large dichroism in the angular distribution (LMDAD). The LMDAD effect has a $cos^2\theta$ dependence, where θ is the angle between the projection of the light polarisation and the sample magnetisation direction. This gives direct information about the magnetisation direction with respect to the plane of incidence of the p-polarised synchrotron beam. This work is funded by BMBF (05KS7UM1)

MA 6.16 Mon 18:30 H10

Kinetically controlled growth of iron oxides — •Mehrdad Baghaie Yazdi, David Bierwagen, and Lambert Alff — TU Darmstadt, Materialwissenschaft, Darmstadt, Deutschland

Magnetite is a promising material for spintronics applications due to its high Curie-temperature of 858 K, predicted half-metallicity and fairly low resistivity of 5.2 $\times 10^{-3}$ Ωcm. We have deposited magnetite thin films using reactive rf-magnetron sputtering on MgO and c-cut Al_2O_3 substrates. Furthermore the aforementioned substrate materials can also act as an insulating tunneling barrier in magnetic tunnel junction structures, making the epitaxial growth of all-oxide heterostructures possible.

The thin film samples were characterized by x-ray diffraction and reflectometry, superconducting quantum interference magnetometry, Raman spectroscopy and temperature dependent resistivity. The sample properties were compared to bulk magnetite, which acts as a quality standard. In particular, the Verwey transition is highly sensitive to material stoichiometry and defects. Optimized thin films exhibit an extremely sharp Verwey transition, in both magnetic and resistive measurments, between 119 K and 132 K. We have further established a sputtering process, which allows for a kinetically controlled growth of iron oxide phases ranging from α-Fe_2O_3 to Fe_3O_4+ Fe.

The authors thank *LOEWE-Centre of Excellence AdRIA* for financial support and Dr. Emanuel Ionescu for his time and help with Microraman measurements.

MA 6.17 Mon 18:45 H10

Perpendicular magnetic anisotropy in Co_3Pt thin films — •Christian Schubert, Denys Makarov, Christoph Brombacher, Katja Neupert, Mirko Kehr, Walter Hoyer, and Manfred Albrecht — Chemnitz University of Technology, Institute of Physics, D-09107 Chemnitz, Germany

Binary alloys of M_xPt_{1-x} (M = Fe, and Co) prepared as thin films tend to show a strong perpendicular magnetic anisotropy (PMA), making them good candidates for magnetic recording media or sensoric devices. The magnetic response of M_xPt_{1-x} films can be strongly modified by the degree of composition, film thickness, deposition temperature, and nature of substrate. Thus, chemically disordered CoPt alloys with (111) texture exhibit an unexpected PMA related to an anisotropic short-range order (SRO) effect [1]. Here we present an investigation of structural and magnetic properties of Co_3Pt alloy films in the thickness range from 5 to 20 nm. The magnetic layers were deposited using magnetron co-sputtering on thermally oxidized Si(100) wafers. Interestingly, even when deposited at room temperature, these films reveal the presence of a strong PMA (K_U = 0.6 MJ/m^3) with a full remanence in the out-of-plane direction. Furthermore, owing to the high Co content, the alloy has a rather high value of saturation magnetization of about 0.8 T. To access the structural properties of the alloy, a x-ray diffraction study was carried out. However, no superstructure peaks which might be attributed to a chemical long range order have been observed indicating that SRO is the origin for the PMA. [1] Y. Yamada et al., *J. Appl. Phys.* **83** (1998) 6527.