DS 15 Thin magnetic films

Time: Wednesday 15:30–17:15 Room: GER 38

Invited Talk DS 15.1 Wed 15:30 GER 38

Nanoparticulate films of high anisotropy magnetic materials: A status quo — •Bernd Rellinghaus — IFW Dresden, P.O. Box 270116, D-01171 Dresden

In recent years, attempts to push the areal storage density of materials for single-grain-per-bit hard disk media towards their physical (superparamagnetic) limits have gained significant attention. However, a breakthrough in preparing films of high anisotropy $L1_0$-FePt nanoparticles for this purpose is yet to be awaited. The talk reviews the advantages and shortcomings of both, colloidal and gas phase preparation routes – the two most wide-spread approaches in the field. Whereas wet-chemical preparation allows for precise size control and periodic particle arrangement on a substrate, the simultaneous provision of high magnetic anisotropy and texture seems problematic. Advantageous to the gas phase preparation is the possibility to thermally anneal such particles prior to their deposition on a substrate. This in principle allows to disentangle inter- and intra-particle sintering processes from the $L1_0$-ordering. The dependence of the degree of $L1_0$ order in FePt nanoparticles on the local environment, particle size, time, and temperature will be reported. Potential measures to overcome the present obstacles by interdisciplinarily combining different methods will be given as an outlook.

DS 15.2 Wed 16:15 GER 38

Order by smoothness - crystallization at amorphous interfaces — •Andreas Liebig[1], Hans Lidbaum[2], Panagiotis Korelis[1], Gabriella Andersson[1], Klaus Leifer[2], and Björgvin Hjörvarsson[1] — [1]Department of Physics, Uppsala University, Box-530, SE-75121 Uppsala, Sweden — [2]Department of Engineering Sciences, Uppsala University, Box 534, SE-751 21 Uppsala, Sweden

The structural and magnetic properties of amorphous $Fe_{90}Zr_{10}$ thin films and multilayers have been investigated by x-ray diffraction and TEM. Crystallites of limited size are observed at the interface between the iron-zirconium layers and the underlying amorphous oxide. The interface related seeding of crystallites suggests the presence of a purely symmetry-induced ordering.

The magnetic properties are strongly affected by the interface density. The ordering temperature for thin films is around 200 K, which is comparable to the ordering temperature for bulk samples. For samples with high interface density, the Curie temperature can be increased up to 360 K. The origin of the shift in the ordering temperature, as well as the interface induced crystallization will be discussed.

DS 15.3 Wed 16:30 GER 38

Substrate dependent Mn Valence Instability on $La_{2/3}Ca_{1/3}MnO_3$ Thin Films — •Sergio Valencia[1], Andreas Gaupp[1], Alexei Erko[1], Wolfgang Gudat[1], Libertad Abad[2], Lluís Balcells[2], and Benjamin Martínez[2] — [1]BESSY, Albert-Einstein-Str. 15, D-12489, Berlin, Germany — [2]Institut de Ciéncia de Materials de Barcelona, Campus de la UAB, E-08193, Bellaterra, Spain

The Mn valence state of $La_{2/3}Ca_{1/3}MnO_3$ (LCMO) thin films grown on $SrTiO_3$ (STO), $LaAlO_3$ (LAO) and $NdGaO_3$ (NGO) substrates has been studied by X-ray absorption spectroscopy: The spectra at the Mn K and L edges and at the O K edge show the presence of a divalent Mn component, besides the expected $Mn_3^+ : Mn_4^+ = 2/3 : 1/3$ mixed valence state, for as-grown films related to the air exposure of the samples. For films grown on STO the Mn_2^+ presence is constant in time, while an increase of it is observed for films on LAO and NGO substrates. The origin of the Mn valence instability giving rise to the Mn_2^+ formation and the substrate dependent differences are discussed and tentatively related to the surface homogeneity of the substrate prior to the deposition of the material.

DS 15.4 Wed 16:45 GER 38

Rare-Earth Scandate Multi-Layer Thin Films prepared by Pulsed Laser Deposition — •T. Heeg[1], J. Schubert[1], Ch. Buchal[1], M. Boese[2], and M. Luysberg[2] — [1]Institut für Schichten und Grenzflächen ISG1-IT/CNI, Forschungszentrum Jülich GmbH, D-52425 Jülich, Germany — [2]Institut für Festkörperforschung IFF, ER-C and CNI, Forschungszentrum Jülich GmbH, D-52425 Jülich, Germany

The rare-earth scandates have gained considerable attention as candidate materials for the replacement of SiO_2 in silicon MOSFETs in either amorphous or epitaxial form. In this work, amorphous as well as epitaxial multi-layer systems consisting of scandate and titanate layers were grown in situ on different substrates using PLD. $BaTiO_3$ was used in combination with $GdScO_3$, and $SrTiO_3$ was combined with $DyScO_3$. The thickness ratio and the total number of layers were varied. RBS and RBS/channeling were used to investigate the stoichiometry and crystal quality of the films. XRD measurements were performed to analyze the crystal structure. HRTEM was used to get detailed information on the orientation relationship between scandate and titanate layers as well as on the strain present in the layers.

To determine the electrical properties of the amorphous multi-layer films on silicon substrates, the results of several samples with a thickness from 26 nm to 100 nm have been evaluated using an EOT plot. To investigate the dielectric properties of the epitaxial films, $SrRuO_3$ covered $SrTiO_3$(100)-substrates were used for the electrical characterization. The amorphous films have a dielectric constant of 35, whereas the epitaxial films show a higher value of 60.

DS 15.5 Wed 17:00 GER 38

Isolated cadmium atoms in different environments on nickel surfaces — •Wolf-Dietrich Zeitz — Hahn-Meitner-Institut, Glienicker Strasse 100, 14109 Berlin

The electronic configurations of isolated Cd atoms on Ni surfaces were measured by the PAC tracer method. The Cd impurities could be positioned at steps, kinks, in and at the surface layers of ferromagnetic nickel single crystals. The outstanding result of the experiments is a dependence of the magnetic hyperfine field on the coordination number.

The presentation at this conference shall give a review on the experimetal findings and the interpretation which includes band structure calculations.

According to the calcutations, the measured electric gradients are interpreted by the distribution of electrons among different p-sublevels, while the magnetic hyperfine fields are explained from the polarisation in the local density of s-states in the conduction band.

In addition, the calculations give predictions for other sp-elements on surfaces of ferromagnets and thus present a generalised view of this topic.