MA 8: Magnetic Particles / Clusters I

Time: Monday 17:45–19:15 Location: EB 202

MA 8.1 Mon 17:45 EB 202

X-ray magnetic circular dichroism of size-selected CoRh clusters — •Torben Beeck[1], Ivan Baev[1], Kai Chen[2], Michael Martins[1], and Wilfried Wurth[1] — [1]Institut für Experimentalphysik, Universität Hamburg, Luruper Chaussee 149, 22761 Hamburg — [2]Institut für Werkstoffforschung, Max-Planck-Straße 1, 21502 Geesthacht

At the UE52 SGM beamline at BESSY II we investigated mass-selected Co_xRh_y clusters with up to four atoms per cluster. The clusters were deposited in situ via soft landing on a remanently magnetized Ni/Cu(100) surface and probed with left and right circular polarized light at the Co $L_{2,3}$ edges. The magnetic response varying with different Co/Rh compositions showing none, weak or strong dichroism. For Co_1Rh_2 it appears that the coupling to the substrate is changed to antiferromagnetic. Because of the rapid changes in dichroism and the small atomic numbers these type of clusters are suitable for comparison with complex theoretical calculations.

This work is supported by the DFG in the framework of the SFB 668 subproject A7.

MA 8.2 Mon 18:00 EB 202

XMCD studies of Ni nanoclusters on a graphene moiré template at the new WERA/MPI-IS 7T XMCD end station at ANKA — •Thomas Tietze[1], Philipp Leicht[2], Muriel Sicot[2], Mikhail Fonin[2], Peter Nagel[3], Stefan Schuppler[3], Michael Merz[3], and Eberhard Goering[1] — [1]Max-Planck-Institut für Intelligente Systeme, 70569 Stuttgart — [2]Fachbereich Physik, Universität Konstanz, 78464 Konstanz — [3]Karlsruher Institut für Technologie, Institut für Festkörperphysik, 76021 Karlsruhe

Graphene grown on noble metal surfaces like Rhodium or Iridium can serve as a template for the growth of magnetic nanoparticles, e.g. Ni nano islands and ellipsoids. Here, we investigated the magnetic properties of in-situ grown Ni nanostructures on a graphene Moiré template on an Ir (111) single crystal by means of x-ray magnetic circular dichroism (XMCD). We investigated nanoclusters of different shapes, triangular (length 10 nm, height 2 nm) and spherical (diameter 4-5 nm), at different nominal coverage from only 0.2 to 1 monolayer, respectively. To reveal the magnetic behavior, we measured the Ni L2,3 edge XMCD signal at low temperatures (15 K) and at various applied magnetic fields up to 7 Tesla with the new fast switching MPI-IS XMCD end station at the WERA beamline at ANKA. We used sum rules to extract spin and orbital magnetic moments and found enhanced orbital moments for low nominal coverage. In order to study the magnetic anisotropy we performed XMCD measurements in different geometries to probe the in- and out-of-plane components of the Ni magnetic moments.

MA 8.3 Mon 18:15 EB 202

Site specific spin canting in Fe oxide nanoparticles — •Anne Warland[1], Carolin Antoniak[1], Masih Darbandi[1], Detlef Schmitz[2], Tobias Euwens[1], and Heiko Wende[1] — [1]Fakultät für Physik und CeNIDE — [2]Helmholtz-Zentrum Berlin für Materialien und Energie

It is well known that Fe oxide nanoparticles can hardly be saturated due to spin canting at the surface. From our Mössbauer spectroscopy measurements we obtained indications that the canting takes place mainly at the Fe sites which are octahedrally surrounded by the oxygen. Contrary, the Fe spins at tetrahedral sites are only slightly canted. Explanations for this canting effect are vacancies and missing bonds at the particles surface. XMCD spectroscopy at the Fe $L_{3,2}$ absorption edges allows to separate the magnetic contributions of Fe^{2+} and Fe^{3+} ions at tetrahedral and octahedral sites. We used this technique to determine the field dependent magnetization and to monitor the spin canting site specifically. Bare iron oxide nanoparticles of different sizes (3nm, 6nm and 9nm) have been investigated in magnetic fields up to 5T. This work is supported by DFG(WE2623/3-1)

MA 8.4 Mon 18:30 EB 202

Self assembled Iron Oxide Nanoparticles - From a 2D powder to a single crystal — •Elisabeth Josten[1], Ulrich Rücker[1], Manuel Angst[1], Paul Zakalek[1], Doris Meertens[2], Erik Wetterskog[3], Oliver Seeck[4], Florian Menau[5], Lennard Bergström[3], and Thomas Brückel[1] — [1]JCNS-2 and PGI-4, Forschungszentrum Jülich, Germany — [2]ER-C and PGI-5, Forschungszentrum Jülich, Germany — [3]Stockholm Universitet, Department of Materials and Environmental Chemistry, Stockholm, Sweden — [4]DESY, Hamburg, Germany — [5]Synchrotron Soleil, Gif-sur-Yvette, France

Fundamental research on magnetic nanostructures is an important part of todays science in the field of information technology. Highly ordered 3 dimensional structures of nanoparticles are model systems to study the magnetic inter-particle interactions.

In this context, monodisperse Fe_2O_3 nanoparticles have been deposited on a substrate to form highly ordered superstructures (mesocrystals) using a drop casting method. In a first step, structural characterization was carried out by SEM, AFM, TEM and GISAXS. Due to the arbitrary orientation of the mesocrystals on the substrate the grazing incidence scattering experiments cannot yield the full supercrystal structure information, only a powder average. In this study a single mesocrystal was detached from the sample using focused ion beam preparation techniques, and was investigated with small angle diffraction for its structure.

MA 8.5 Mon 18:45 EB 202

Tunable colloidal superlattice growth modes using iron oxide nanoparticles — •David Greving[1], Oleg Petracic[1], Durga Mishra[1], Giovanni A. Badini Confalonieri[1], Jan Perlich[2], Boris P. Toperverg[1], and Hartmut Zabel[1] — [1]Institut für Experimentalphysik/Festkörperphysik, Ruhr-Universität Bochum, 44780 Bochum — [2]HASYLAB at DESY, Notkestrasse 85, 22603 Hamburg

The self-organization of nanoparticles (NPs) shows a comparable behavior to the crystalline growth of atoms. Therefore, systematically investigating those parameters influencing the colloidal growth is an important task when aiming at novel magnetic or electronic materials composed from NPs. To this end we employed two different self-assembly techniques, i.e. spin-coating and sedimentation of chemically synthesized iron oxide NPs with a mean diameter of 20 nm. We used various substrates, i.e. Si, Si with thermal oxide, Si with PMMA coating, Al, Al_2O_3 and MgO, to specifically influence the particle-to-substrate forces, thus tuning one of the main factors determining the corresponding growth mode. We were able to observe all three NP growth modes analogous to that found in classical thin film growth, i.e. Vollmer-Weber-, Frank-v.d.-Merwe- and Stranski-Krastanov. The systems are structurally and magnetically characterized using scanning electron microscopy, grazing incidence small angle x-ray scattering (GISAXS) and superconducting quantum interference device magnetometry, respectively.

MA 8.6 Mon 19:00 EB 202

Correlation of superparamagnetic relaxation with magnetic dipole and exchange interaction in capped iron-oxide nanoparticles — •Joachim Landers, Frank Stromberg, Masih Darbandi, Werner Keune, and Heiko Wende — Faculty of Physics and Center for Nanointegration Duisburg-Essen (CeNIDE), University of Duisburg-Essen

Iron-oxide nanoparticles with a mean diameter of 6 nm capped with organic surfactants and/or silica shells of various thicknesses have been prepared by a microemulsion method. The resulting different particle distances imply a tunable contribution of magnetic dipole interaction to the effective magnetic anisotropy. Bare particles of the same size were used as a reference. To determine superparamagnetic relaxation parameters temperature dependent Mössbauer spectra were measured in the range of 4.2 - 300 K. Calculations using a many state relaxation model of magnetic orientations were done to estimate effective anisotropies which are influenced by surface and interaction contributions. A decrease of the blocking temperature with progressive coating thicknesses was observed by several FC-ZFC magnetization measurements in good agreement with Mössbauer results. Calculated values of the relaxation frequency were compared with AC susceptibility and thermoremanent relaxation measurement (TRM) data in attempt to obtain information about surface and volume contributions to the distribution of anisotropy energies. Supported by DFG (WE 2623/3-1)