O 87: Methods: Other (experimental)

Time: Friday 11:15–12:45 Location: H42

O 87.1 Fri 11:15 H42

Determining the internal structure and morphology of nanoparticle films using element-specific X-ray techniques — •Marc Sauerbrey, Ardalan Zargham, Thomas Schmidt, Jan Ingo Flege, and Jens Falta — Institute of Solid State Physics, University of Bremen, 28359 Bremen, Germany

The nanoscopic structure of colloidal nanoparticle films is investigated using X-ray Standing Waves in Total External Reflection (TER-XSW) together with X-ray Reflectometry (XRR). The period of the standing wave field and the distance between the mirror surface and the antinodes are determined by the incidence angle (θ) of the X-ray beam. While varying θ, the interference pattern moves through the adsorbed particles and excites fluorescence. The detection of this angle-dependent fluorescence signal allows to draw conclusions on the vertical position of the nanoparticles with subnanometer resolution. As a model system we investigated an Au-coated Si substrate functionalized with a self-assembled monolayer (SAM) of hexadecanethiol covered by a monolayer of $CoPt_3$ nanoparticles prepared by dip coating. Besides the determination of the vertical position of adsorbed particles, this technique also allows to resolve the internal structure of colloidal particles.

O 87.2 Fri 11:30 H42

Double Photoemission from Pb(111) — •Robert Wallauer[1], Stefan Voss[1], Till Jahnke[1], Achim Czasch[1], Lothar Schmidt[1], Nadine Neumann[1], Jasmin Titze[1], Hung-Keun Kim[1], Götz Berner[2], Michael Sing[2], Ralph Cleassen[2], Juan Carlos Campuzano[3], Horst Schmidt-Böcking[1], and Reinhard Dörner[1] — [1]IKF, Universität Frankfurt — [2]EP4, Universität Würzburg — [3]University of Illinois at Chicago

We investigate the angular resolved single photoemission (ARPES) and double photoemission (DPE) from a Pb(111) crystal in the normal and superconducting state using a momentum resolved coincidence detection method(often referred to as COLTRIMS)[1]. The experiment was performed at the synchrotron in Berlin (BESSY-II) in single bunch operation mode at photon energies around 20 to 25eV.

Theory [2] predicts that Cooper-pairs can be observed using coincidence photoemission. We suspect that our energy resolution (around 500 meV) prevents us from observing the pairs, since the calculation predicts differences (between the normal and SC states) only in an energy range of a few meV. For photon energies above 25eV the DPE current is dominated by Auger-processes involving the 5d(5/2) and 5d(3/2) core levels emitting Auger-electrons with a angular dependence on the emission direction of the Photoelectron which is not understood so far.

[1] M.Hattass et. al, Rev. Sci. Instr., 75, 2373 (2004) [2] K. A. Kouzakov and J. Berakdar Phys. Rev. Lett., 91, 257007 (2003)

O 87.3 Fri 11:45 H42

A fast, full multichannel reflectance difference spectrometer — •Chunguang Hu[1,2], Lidong Sun[1], Michael Hohage[1], and Peter Zeppenfeld[1] — [1]Institut für Experimentalphysik, Johannes-Kepler-Universität Linz, Austria — [2]State Key Lab of Precision Measuring Technology and Instruments, Tianjin University, China

With its high surface sensitivity, reflectance difference spectroscopy (RDS) has been proven to be a versatile tool for the scientific research in surface science and thin film growth. We report the development of a fast, multiwavelength RD spectrometer using a rotating compensator (RC) for signal modulation. The new spectrometer measures the optical anisotropy in the entire spectral range from 1.5 to >4.5eV simultaneously using a photodiode array with 1024 channels as detector. We will demonstrate that the new RDS is particularly suitable for in-situ monitoring of thin film growth and other surface processes by illustrating its application in the research of organic thin film growth.

O 87.4 Fri 12:00 H42

SMART-II: the Next Generation of Aberration Corrected Spectro-Microscopy — Helder Marchetto, Marcel Springer, •Thomas Schmidt, and Hans-Joachim Freund — Fritz Haber Institute of the MPG, Dept. CP, Berlin, Germany

The unique SMART (Spectro-Microscope with Aberration correction for many Relevant Techniques), built up within a collaboration [1] with the University Würzburg, TU Darmstadt, TU Clausthal and Zeiss (LEO) Oberkochen, combines electron spectroscopy with electron microscopy at high lateral and energy resolution to obtain spatially resolved information about the morphology, chemical distribution, work function and structural properties on nanometer scale. The basic instrument is a Low Energy Electron Microscope (LEEM) and Photo-Emission Electron Microscope (PEEM) equipped with an imaging energy analyzer and an aberration corrector, compensating simultaneously for both, the spherical and the chromatic aberrations. This leads to an outstanding lateral resolution of 2.6 nm which is twice as good as for an uncompensated LEEM/PEEM. Basing on the optical design of this prototype instrument, a new microscope is under construction, called SMART-II. It combines a commercial LEEM instrument with the well proven corrector system of SMART-I and a newly designed electrostatic imaging energy filter. We will discuss the advantages of this concept which are threefold: (a) higher electronic stability and therefore improved lateral resolution, (b) an improved reliability and (c) better maintenance for routine operation. [1] R. Fink et al., J. Electr. Spectrosc. Rel. Phen. 84, 231 (1997)

O 87.5 Fri 12:15 H42

Collinear Generation of ultrashort UV and XUV pulses for pump/probe spectroscopy — •Elisabeth Bothschafter[1,2], Agustin Schiffrin[1], Vladislav Yakovlev[1,3], Ferenc Krausz[1,3], Ralph Ernstorfer[1,2], and Reinhard Kienberger[1,2] — [1]Max-Planck-Institut für Quantenoptik, Hans-Kopfermann-Straße 1, D-85748 Garching, Germany — [2]Lehrstuhl für Experimentalphysik I (E11) Technische Universität München, James Franck Strasse, D-85748 Garching, Germany — [3]Department für Physik, Ludwig-Maximilians-Universität, Am Coulombwall 1, D-85748 Garching, Germany

The investigation of the dynamics of excited electronic states in molecular and solid state systems on the few femtosecond time scale is a veritable challenge and requires the availability of ultrashort pulses in different spectral domains.

For application in future UV pump/XUV probe experiments, we demonstrate and characterize the collinear generation of sub-4 fs ultraviolet (UV) pulses and attosecond extreme ultraviolet pulses (XUV) pulses via nonlinear interaction of a sub-1.5 cycle near infrared/visible (NIR) laser pulse with noble gas atoms. The combination of third-order and high harmonic generation in a setup comprising two subsequent gas targets in a single laser focus provides inherently synchronized UV pulses with a photon energy of ∼5 eV and a pulse energy of ∼1 μJ and XUV pulses with a cut-off photon energy of more than 120 eV and up to $\sim 10^7$ photons.

O 87.6 Fri 12:30 H42

Surfaces of Customary Materials - a LEEM Study on Polycrystalline Iron — •Benjamin Borkenhagen[1], Thorsten Franz[2], Gerhard Lilienkamp[1], and Winfried Daum[1] — [1]Institute of Energy Research and Physical Technologies, TU Clausthal, Leibnizstr. 4, 38678 Clausthal-Zellerfeld — [2]ELMITEC GmbH, Albrecht-von-Grodeck-Str. 3, 38678 Clausthal-Zellerfeld

Most contemporary surface science studies are focussed on single crystal surfaces and adsorbates on single crystalline substrates with a limited variety of structural details and surface symmetries. Customary materials, however, are mainly polycrystalline with a large variety of defects and surface orientations which frequently have an important influence on surface processes. The study of such samples needs simultaneously high lateral resolution, information about the local surface symmetry and laterally resolved spectroscopic data. We have applied low energy electron microscopy (LEEM) to polished polycrystalline Fe samples which have been cut from pure bulk material to demonstrate that LEEM/PEEM-related methods meet these requirements. First results exhibit characteristic surface structures depending on the orientation of the grains. Single atomic steps and step bunches are well resolved, and the run of the steps is strongly influenced by grain boundaries and local tension in the microstructure. Small-area LEED with the microscope supplies first information concerning surface lattice and orientation of the grains. Due to the fast image acquisition investigations of thermally activated transformations of the texture and surface reactions appear promising.