KR 3: Poster: Crystallography in Nanoscience

Time: Wednesday 15:00–17:30 Location: Poster A

KR 3.1 Wed 15:00 Poster A

Physical aspects of the growth dynamics of plasmonic structures — •Merle Becker[1], Bernhard Grotz[1], Jens Pflaum[2], Fedor Jelezko[1], and Jörg Wrachtrup[1] — [1]3. Physikalisches Institut, Universität Stuttgart, 70550 Stuttgart, Germany — [2]Inst. Exp. Phys. VI, Julius-Maximilians Univ. and ZAE Bayern, 97074 Wuerzburg, Germany

In recent years, the importance of nanostructured materials for applications in e.g. nano-optics, plasmonics and as components of sensing devices strongly increased. Production by lithographic methods like optical, e-beam or ion-beam lithography [1] results in controllable and reproducible structures, however with the drawback of being highly intricate and expensive. In this contribution we demonstrate an alternative approach to compass these problems which is the use of chemical syntheses in combination with self-aggregation [2]. Silver nanowires grown in solution are investigated to optimize their performance as plasmon waveguides and antennae. Distributions of length and diameter in dependence on time and consequential development of aspect ratios of nanowires reveal influences of PVP on surface energies of participating faces. Broadenings of the distributions of length and diameter during growth are investigated and can be related to surface roughening of the (111) and (100) faces during growth process.

[1] Pelton, M. Laser&Photon. Rev. 2, 136-159 (2008) [2] Xia, Y. et al. Adv. Mater. 15, 353-389 (2003)

KR 3.2 Wed 15:00 Poster A

Structure of W-C-nanodots prepared by focused electron beam induced deposition as determined by electron diffraction — •Iryna Andrusenko[1], Tatiana Gorelik[1], Andrew Stewart[1], Ute Kolb[1], Mike Strauss[2], Roland Sachser[3], Fabrizio Porrati[3], and Michael Huth[3] — [1]Institute of Physical Chemistry, University Mainz, Mainz, Germany — [2]Department of Structural Biology, MPI of Biophysics, Frankfurt/Main, Germany — [3]Physikalisches Institut, Goethe University, Frankfurt/Main, Germany

Ordered two-dimensional nanodot lattices of various lattice pitches were fabricated from $W(CO)_6$ precursor by focused electron-beam-induced deposition (FEBID) on amorphous carbon or silicon templates. Electron transmission microscopy images and diffraction patterns were collected at 300 kV with a FEG-TEM. Tomographic reconstructions from images taken at liquid nitrogen temperature were generated by weighted back-projection from 85 zero-loss filtered images taken over a tilt range of ±63 degrees at a nominal defocus of -1 μm and a magnification of 48000. Electron diffraction patterns, providing resolution superior to imaging techniques, were performed using selected area electron diffraction as well as a semi-parallel beam of 50 nm diameter. Diffraction patterns of the full 1x1 μm dot lattice area delivered a mean distance of about 2.3 Å indicating a W-C bond length. Diffraction patterns of single particles have been collected in order to reconstruct high resolution images. The structural features of FEBID grown W-C-nanodots investigated by electron diffraction were subsequently correlated with Raman spectroscopy results.

KR 3.3 Wed 15:00 Poster A

Detailed Analysis of the Small Angle X-Ray Scattering of ordered mesoporous titania compounds calcined at different temperatures — •Lars Robben[1] and Adel A. Ismail[2] — [1]Institut für Mineralogie und ZfM, Leibniz Universität Hannover — [2]Institut für Technische Chemie und ZfM, Leibniz Universität Hannover

Small Angle X-Ray Scattering (SAXS) is a powerfull method for the characterization of ordered mesoporous materials (OMMs). OMMs are principially two-phases systems: A material, for example SiO_2 or TiO_2, contains pores with a diameter between 2-50 nm with a regular ordering. The ordering scheme as well as the size and shape of the pores can be controlled by the synthesis conditions. In SAXS experiments the electron density difference between the pores and the material generates Bragg-Reflections which can be used to elucidate the type of crystallographic lattice of the ordering scheme of the pores and to calculate the lattice parameter. An important point with respect to the technical application of TiO_2-OMMs is the crystallinity of the material because a higher crystallinity ensures a better photoactivity for catalytic purposes. Here we present SAXS investigations of TiO_2-OMM calcined at different temperatures and review the assignment of the symmetry group. Furthermore we clarify the main processes which determine the development of the OMM during calcination. Most important in this respect is the interdependency between the crystallinity of the material and the quality (that is the pore shape and the regularity of the lattice) of the mesoporous system.

KR 3.4 Wed 15:00 Poster A

Generation of hard X-ray radiation using the triboelectric effect — •Maximilian Rühl[1], Emanuel Gutmann[1], Erik Mehner[1], Hartmut Stöcker[1], and Dirk C. Meyer[2] — [1]Nachwuchsgruppe Nanostrukturphysik, Institut für Strukturphysik, TU Dresden, 01069 Dresden — [2]Institut für Experimentelle Physik, TU Bergakademie Freiberg, 09596 Freiberg

To meet the demands of upcoming imaging for medical demands and scientific methods for structure investigation, generation of X-rays using miniaturized radiation sources is an interesting field of research. Beside approaches based on the ionizing and electron accellerating properties of high electric fields around pyroelectric crystals also the use of a tribomicroplasma generated in the vicinity of the peeling point of two different polymers is promising [1]. We report on the generation of hard X-ray radiation by crawling various peeling tapes in a medium vacuum. Beside vacuum housing and pumps as instrumentation only an electric motor, two rolls and a metal foil as target material are necessary. The spectral distribution of thus generated X-rays was analyzed using an energy dispersive Si (Li) detector. In dependence of peeling speed, pressure and choice of polymer material electrons with energies high enough to excite characteristic X-ray emission in the hard X-ray region are produced. The results are discussed in terms of theory of triboelectricity [2]. [1] C. G. Camara et al. Correlation between nanosecond X-ray flashes and stick-slip friction in peeling tape, Nature 455 (2008) 1089-1092 [2] P. A. Thießen, K. Meyer, G. Heinicke, Grundlagen der Tribochemie (1967) Akademie-Verlag, Berlin

KR 3.5 Wed 15:00 Poster A

Oxygen vacancy contribution on Anisotropic Anomalous Scattering of rutile TiO_2 — •Carsten Richter[1], Matthias Zschornak[1], Hartmut Stöcker[1], Tilmann Leisegang[1], Dmitri Novikov[2], and Dirk C. Meyer[3] — [1]Nachwuchsgruppe Nanostrukturphysik, Institute of Structural Physics, TU Dresden, Germany — [2]Hamburger Synchrotronstrahlungslabor HASYLAB at DESY, 22603 Hamburg, Germany — [3]Institute of Experimental Physics, TU Bergakademie Freiberg, Germany

The unique potential of *Anisotropic Anomalous Scattering* (AAS) for investigation of randomly distributed point defects has been discussed theoretically by Dmitrienko and Ovchinnikova [1]. Here, we use this approach to study influences of oxygen vacancies in rutile TiO_2 on the resonant scattering contributions at the Ti-K absorption edge. First energy dependent AAS experiments have been performed on a series of single crystal wafers with different oxygen concentrations obtained by annealing at a temperature of 800 °C in a vacuum of about 10^{-6} mbar for different durations. Measurements were carried out at DESY/HASYLAB on 'forbidden' 001 and allowed 111 reflections. An interpretation based on vacancy-induced static Ti displacements from high- to low-symmetry positions will be presented.

[1]*V.E. Dmitrienko, E.N.Ovchinnikova: Acta Cryst. A56 (2000) 340-347.