CPP 21 Nanoparticles

Zeit: Dienstag 09:45–11:00 Raum: TU C243

CPP 21.1 Di 09:45 TU C243

Morphology of tempered gold nanoparticle thin films as a function of film thickness — •Stephan V. Roth[1], Harald Walter[2], Rainer Gehrke[1], and Peter Müller-Buschbaum[3] — [1]HASYLAB at DESY, Notkestr. 85, D-22603 Hamburg, Germany — [2]CSEM SA, Badenerstrasse 569, CH-8048 Zürich, Switzerland — [3]TU München Physik Department LS E13,James-Franck-Str.1, D-85747 Garching, Germany

Controlling the morphology of noble metal nanoparticle layers is of high technological and scientific interest. The broad field of application of such layers includes solar cells [1], bio-recognition and optocelectronic devices. This is due to the plasmon resonance in noble metal nanoparticles leading to strong absorption bands in the visible light. The plasmon resonance depends strongly on the nanoparticle layer structure and morphology. A very simple route to structuring is low-temperature annealing [2]. We investigated the evolution of evaporated gold nanoparticle layers as a function of nanoparticle layer thickness (3nm-8nm) and annealing time at 300°C ($\leq$24h). To characterize the samples we used optical transmission interferometry and grazing incidence ultra small-angle x-ray scattering (GIUSAX). The GIUSAX measurements were performed at the beamline BW4 at HASYLAB. We present first results, showing an increasing most-prominent in-plane length with annealing time and correlate it with the changes in the plasmon resonance.

[1] M. Westphalen et al., *Solar Energy Materials & Solar Cells* **61**, 97 (2000)
[2] P. Müller-Buschbaum et al., *Europhys. Lett.* **40**, 655 (1997)

CPP 21.2 Di 10:00 TU C243

Third-Harmonic Generation from Individual Gold Nanoparticles: A Size-dependent Nonlinear Susceptibility — •Markus Lippitz, Meindert A. van Dijk, and Michel Orrit — MoNOS, Huygens Laboratory, Universiteit Leiden, P.O. Box 9504, 2300 RA Leiden, The Netherlands

Individual gold colloids with diameters below 100 nm are appealing labels in biophysics because in contrast to normal fluorescent dyes, they neither show photobleaching nor blinking. We report the first observation of third-harmonic signals from individual gold colloids down to 40 nm diameter. Excited with 1-ps pulses at 1500 nm, the colloids generate 500-nm light, close to the plasmon resonance. Furthermore, we found the third-harmonic intensity to vary as the fourth power of the diameter of the colloids, in stark contrast with the sixth-power dependence expected for the nonlinear response of bound electrons. It can be explained by the nonlinear optical response of the free electrons, leading to a size-dependent nonlinear susceptibility. We expect from this size dependence that the use of 100-fs pulses could reduce the detectable colloid size down to 15 nm.

CPP 21.3 Di 10:15 TU C243

Structure determination of CdS nanoparticles using synchrotron radiation: New methods and results — •Franziska Niederdraenk[1], Andreas Stahl[1], Christian Kumpf[1], Reinhard Neder[2], and Eberhard Umbach[1] — [1]Experimentelle Physik II, Univ. Würzburg — [2]Inst. für Mineralogie und Kristallstrukturlehre, Univ. Würzburg

Semiconductor nanoparticles are of increasing interest for both, applied and fundamental research. Besides applications in material science, they are used as markers in biology and for cancer treatment. Furthermore, 1-5 nm large particles are of particular interest in fundamental research since they represent a size scale between solid state and molecular physics.

However, a precise determination of geometrical parameters is difficult in this range. Potentially, diffraction methods are able to provide precise structural information, but common analysis methods do not yield precise results in the particle range below 5 nm. We present a new approach for the analysis of powder diffraction data obtained from small particles. The entire particle is modelled and its diffractogram is computed using the Debye formula. This allows us to address not only fundamental parameters like size and crystal structure, but also the shape, stress, relaxation effects, and stacking faults.

CPP 21.4 Di 10:30 TU C243

Energy Transfer in Supramolecular Assemblies of Semiconductor Nanoparticles and Porphyrins — •Thomas Blaudeck[1], Edvard Zenkevich[2], Alexander Shulga[2], Frank Cichos[1], and Christian von Borczyskowski[3] — [1]Photonics and Optical Materials, Institute of Physics, TU Chemnitz, 09107 Chemnitz, Germany — [2]Institute of Molecular and Atomic Physics, National Academy of Science, Minsk 220072, Belarus — [3]Optical Spectroscopy and Molecular Physics, Institute of Physics, TU Chemnitz, 09107 Chemnitz, Germany

We report on an efficient energy transfer process in colloidal systems of semiconducter nanoparticles (NPs) and organic dyes. The focus is set on assemblies of CdSe core NPs and tetra-(m-pyridyl)-porphyrin molecules dispersed in toluene. Steady-state titration experiments show an inhibition of the NP emission with increasing porphyrin concentration. For such an assembly, the porphyrin emission intensity is enhanced. Photoluminescence excitation spectra at porphyrin emission also reveal a significant influence of the NP concentration. These facts are confirmed by time-resolved photoluminescence measurements as they clearly show a raising component on the molecules emission band in presence of the NP. We interpret these resuls as proof for self-organization of the porphyrins on the NP surface and a directed energy transfer from the NP to the molecule.

CPP 21.5 Di 10:45 TU C243

Thin films of titania nanoparticles via a sol/gel templated synthesis — •Jochen S. Gutmann, Zaicheng Sun, Yajun Cheng, and Dongha Kim — MPI for Polymer Research, Ackermannweg 10, 55128 Mainz

Amphiphilic block copolymers offer a way to mass fabricate thin, nanostructured organic/inorganic hybrid films. We have developed a simple route to generate Titania nanodot arrays from a sol/gel precursor via spin-coating. The resulting thin films show a dependence of particle size and order, on the preparation conditions of the precursor sol/gel/blockcopolymer mixture. As it is common for Titania synthesized via sol/gel techniques the initial nanodots are amorphous and may be converted into crystalline Titania modifications by thermal treatment. The implications of such treatment steps are studies with scanning electron and scanning force microscopy as well as grazing incidence small angel X-ray scattering. From these sets of experiments an optimum condition for structure formation is deduced and it's use in photophysical application of the Titania nanodot arrays is discussed.