O 12 Nanostrukturen I

Zeit: Freitag 15:45–17:00 Raum: TU EB202

O 12.1 Fr 15:45 TU EB202

PEEM as a tool for the investigation of optical near fields — •M. Cinchetti[1], A. Gloskovskii[1], S. Nepijko[1], G. Schönhense[1], M. Kreiter[2], H. Rochholz[2], D. Bayer[3], C. Wiemann[3], M. Bauer[3], and M. Aeschlimann[3] — [1]Institut für Physik, Johannes Gutenberg-Universität Mainz — [2]MPI für Polymerforschung Mainz — [3]Institut für Physik, Universität Kaiserslautern

Photoemission electron microscopy (PEEM) was used to image the electrons photoemitted from specially tailored Ag nanoparticles (crescents, dots, rods) deposited alternatively on a Si substrate with its native oxide (SiO_x) or on an ITO substrate. Photoemission was induced by illumination with a Hg UV-lamp (photon energy cutoff $\hbar\omega_{UV} = 5.8\,\mathrm{eV}$, wavelength $\lambda_{UV} \geq 220\,\mathrm{nm}$) and with a Ti:Sa femtosecond laser ($\hbar\omega_l = 3.0\,\mathrm{eV}$, $\lambda_l = 400\,\mathrm{nm}$), respectively. Upon illumination at energies above the Ag plasmon frequency the photoemission from the nanoparticles appears rather homogeneous. In contrast, at lower photon energies a strongly spatially localized photoemission signal is recorded. For 400 nm laser radiation the electron emission results from two-photon photoemission as was previously demonstrated by PEEM spectromicroscopy [1]. The results are interpreted as a signature of the local electrical field thus providing a tool to map the optical near field with the resolution of emission electron microscopy.

[1] M. Cinchetti *et al.* , Appl. Phys. Lett. **83** (2003) 1503 and J. El. Spectr. Rel. Phen. **137-140** (2004) 249.

O 12.2 Fr 16:00 TU EB202

Alloy formation of supported Gold nanoparticles at their transition from clusters to solids: Does size matter? — •H.-G. Boyen[1], A. Ethirajan[1], G. Kästle[1], F. Weigl[1], P. Ziemann[1], G. Schmid[2], M.G. Garnier[3], M. Büttner[3] und P. Oelhafen[3] — [1]Abteilung Festkörperphysik, Universität Ulm, D-89069 Ulm — [2]Institut für Anorganische Chemie, Universität Duisburg-Essen, Universitätsstrasse 5-7, D-45117 Essen — [3]Institut für Physik, Universität Basel, Klingelbergstr. 82, CH-4056 Basel

Gold nanoclusters of a size approaching the molecular limit (<3nm) were prepared on Si substrates in order to study alloy formation on the nanometer scale. For this purpose, Indium atoms are deposited on top of the gold particles at room temperature and the formation of $AuIn_2$ is studied by X-ray Photoelectron Spectroscopy (XPS) in situ. It is observed that the alloy formation takes place independent of whether the particles electronically are in an insulating molecular or in a metallic state. Most important, however, closed packed full-shell clusters containing 55 Au atoms are found to exhibit an outstanding stability against alloying despite a large negative heat of formation of the bulk Au-In system. Thus, Au_{55} clusters may play a significant role for the design of nanoscaled devices where chemical inertness is of crucial importance.

O 12.3 Fr 16:15 TU EB202

Collective Surface Plasmon Modes in Ensembles of Gold Particles — •Phillip Olk[1], Jan Seidel[1], Stefan Grafström[1], Lukas Eng[1], Marcell Ott[2], and Martin Möller[2] — [1]Institut für Angewandte Photophysik, TU Dresden, 01062 Dresden — [2]Dt. Wollforschungsinstitut an der RWTH Aachen, 52062 Aachen

The optical properties of self-arranged spherical gold nanoparticles are studied by means of scanning near-field optical microscopy (SNOM) and white-light spectroscopy. Films were prepared by plasma etching of self-arranged monolayers of inverted micelles which were loaded with gold salt[1]. Continuous decoration of both glass and silicon substrates is possible, resulting in typical inter-particle distances of 120 nm and sphere diameters of 10 nm.

When exciting the cluster array in a Kretschmann-Raether-like total-internal-reflection set-up, we find surface-bound optical modes very similar to surface plasmon polaritons on flat continuous metal films. We detect such modes by scanning a dielectric SNOM tip across the surface and recording the amount of evanescent light above the sample surface.

Although our films are far from being *continuous* metal films, the modes are found to decay in intensity with a decay length measuring $> 20\ \mu$m, comparable to the decay length of surface plasmon polaritons in dense metal films. Moreover, the decay length is found to depend on wavelength and in-plane **k** component, indicating the existence of a material-dependent optical band structure.

[1] J. P. Spatz et al., *Langmuir* **16**, 407–415 (2000)

O 12.4 Fr 16:30 TU EB202

Long range order of 2D C_{60} islands on Au(788) — •Nicolas Neel, Jörg Kröger, and Richard Berndt — Institut für Experimentelle und Angewandte Physik Universität Kiel

Submonolayer coverages of C_{60} on Au(788) were investigated by low-temperature scanning tunnelling microscopy. At 0.5 ML coverage self-organized two-dimensional C_{60} islands occur and form well ordered rectangular arrays which extend over distances of hundreds of nanometres. Judging by a large number of images recorded througout the crystal surface we estimate that the arrays cover more than 95 percent of the total area. The formation of the periodic array and observed homogeneity of the island shape are discussed within a model which involves initial nucleation of C_{60} at step edges and preferential adsorption on FCC domains of the gold surface. This adsorption system appears to be a useful template for further deposition of functional units.

O 12.5 Fr 16:45 TU EB202

Single-molecule chemical field-effect transistors with nanometer-sized gates: demonstration and tests — •Frank Jäckel[1], Zhaohui Wang[2], Mark D. Watson[2,3], Klaus Müllen[2], and Jürgen P. Rabe[1] — [1]Humboldt-Universität zu Berlin, Institut für Physik, Newtonstr. 15, 12489 Berlin, Germany — [2]Max-Planck-Institut für Polymerforschung, Ackermannweg 10, 55128 Mainz, Germany — [3]University of Kentucky, Department of Chemistry, Lexington KY 40506-0055, USA

We present a prototypical three-terminal single-molecule device in which the current through a hybrid molecular diode, made from a single molecule in the junction of a scanning tunneling microscope, is modified by the presence of oriented organic charge transfer complexes covalently attached to the molecule in the gap. The set-up represents the first single-molecule transistor with nanometer-sized gates [Phys. Rev. Lett. 92 (2004) 188303]. The observed change in the current-voltage characteristics is explained with an interface dipole originating from the charge transfer complexes. We present tests of this model with respect to the orientation of the dipoles.