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O 29.7 Wed 14:30 P2

Lithographic Fabrication of Clean Nanostructures by Means of Electron-Beam Induced Deposition (EBID) — •M. Schirmer, T. Lukasczyk, H. Marbach, and H.-P. Steinrück — Universität Erlangen-Nürnberg, Lehrstuhl für Physikalische Chemie II, Egerlandstraße 3, D-91058 Erlangen, Germany

EBID is the electron induced decomposition of chemical compounds and the resulting deposition of the non-volatile fragments. By utilizing a sharp spot of electrons well defined deposit structures in the nanometer range can be achieved in a controlled manner. A common difficulty is the contamination of the deposits due to e.g. residual gases. To avoid this problem an ultra high vacuum chamber is utilized. The integrated UHV electron column creates an electron-beam approximately 2 nm in diameter. This instrument in combination with a lithographic package enables the controlled fabrication of clean nanostructures via EBID. For the characterization of the obtained structures the following probe techniques are housed in the same UHV chamber: scanning tunnelling microscopy, scanning Auger electron microscopy and scanning electron microscopy. To generate pure carbon structures the hydrocarbon ethylene (C_2H_4) is tested. Other promising candidates for EBID are chemical compounds like silane (SiH_4), metal hydrides or organometallic compounds. The concept of the project and first results will be discussed.

O 29.8 Wed 14:30 P2

Influence of pulsed laser light on gold triangles: Experiment vs. theory — •Juliane König-Birk[1], Kevin Shuford[2], George Schatz[2], Johannes Boneberg[1], and Paul Leiderer[1] — [1]Fachbereich Physik, LS Prof. Dr. Leiderer, Universität Konstanz, 78457 Konstanz — [2]Chemistry Department, Northwestern University

The optical properties of nanostructures are a topic of current investigations. In analogy to the near-fields around a Hertz dipole we expect near-fields in the surrounding of all nanostructures. To visualize these near-fields we use a method called "optical near-field photography". In our experiments we use e.g. silicon as substrate. The nanostructures, in this case gold triangles, on the substrate are illuminated with femtosecond laserpulses. The intensity is adjusted such that no influence of the illumination is detectable on the bare substrate. When illuminating ARRAYS of nanostructures we observe ablation of the substrate below the gold triangles due to the local intensity enhancement in the optical near-field. Depending on the polarization of the laser light, two or one corner of the triangle show ablation holes. In contrast to simulations on single triangles these effects are rotated at 90°. When illuminating SINGLE nanostructures we observe good agreement with the simulation.

O 29.9 Wed 14:30 P2

Fabrication of Gold Nanoparticles using Nanosphere Lithography in Combination with Laser Tailoring — •Rodica Morarescu, Frank Hubenthal, and Frank Träger — Institut für Physik and Center for Interdisciplinary Nanostructure Science and Technology- CINSaT, Universität Kassel, Heinrich-Plett Strasse 40

In order to overcome the classical limits of silicon technology the use of molecular circuits is a challenging new possibility. The idea behind this is to use molecular wires as active elements,thus reducing circuit dimensions to the molecular scale. As a possible approach to realize such structures, we describe exploratory experiments for the preparation of regular arrays of metal nanoparticles by nanosphere lithography (NSL) and their exploitation as anchor points for the formation of uni- and bi-directional molecular nanowires with a high degree of lateral orientation. Depending on the molecular species and length of the nanowires to be oriented on a substrate surface, the distance between the metal nanoparticles as well as their size and shape have to be chosen independently. For these purpose we apply nanosphere lithography in combination with laser based tailoring of the dimensions of the nanoparticles. In the past we have already achieved laser manipulation of the size and shape of gold and silver nanoparticles. Here we have further produced hexagonally close packed monolayers of latex spheres by the tilt coating method, gold atoms being deposited using electron beam evaporation under ultra high vacuum conditions. An array of triangularly shaped gold nanoparticles remains on the substrate, after the mask is removed. Subsequently, the interparticle spacing and particle shape are varied by laser tailoring.

O 29.10 Wed 14:30 P2

IR-spectroscopy of Pb films and nanowires — •F. Kost[1], T. Kolb[1], R. Lovrincic[1], F. Neubrech[1], A. Pucci[1], M. Jalochowski[2], and G. Fahsold[1] — [1]Kirchhoff-Institut für Physik, Ruprecht-Karls-Universität, 69120 Heidelberg, Germany — [2]Institute of Physics, Maria Curie-Sklodowska University, 20031 Lublin, Poland

The conductivity of metal films and nanowires can be specified via IR spectroscopic measurements which allow analysing these structures in a non-contact mode. The experimental setup enables in-situ investigation in an UHV chamber and therefore, the growth during lead evaporation to a silicon substrate can be investigated. Since the mean free path of electrons at Fermi energy and at room temperature for lead is roughly ten nanometers, classical size effects occur as the film thickness is of this order of magnitude. Quantum size effects are expected as well since the diameter of the nanostructure reaches the range of several ten times the Fermi wavelength [1]. Using a model for charge transport, we describe the measured spectra and explore the development of relaxation rate and plasma frequency and hence get information about scattering effects, band structure and film morphology [2]. In order to obtain nanowires for IR spectroscopic studies, lead is evaporated onto a single-domain stepped silicon substrate. Thereby, solid like nanowires of Pb align parallel to the step edges of the silicon due to self-organization processes [3].

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O 29.11 Wed 14:30 P2

Angle-resolved photoelectron spectroscopy on self-assembled dysprosium-silicide nanowires on vicinal Si(001) — •Sylvia Hagedorn[1], Martina Wanke[1], Gerd Pruskil[1], Mario Dähne[1], Denis Vyalikh[2], Friedrich Schiller[2], Sergeij Molodtsov[2], and Clemens Laubschat[2] — [1]Institut für Festkörperphysik, Technische Universität Berlin, D-10623 Berlin — [2]Institut für Festkörperphysik, Technische Universität Dresden, D-01219 Dresden

Rare-earth silicide nanowires attract considerable interest due to their simple preparation and their anisotropic electronic properties. We report on angle-resolved photoelectron spectroscopy investigations of the electronic structure of dysprosium-silicide nanowires on vicinal Si(001) surfaces at BESSY II. Two types of nanowires are found depending on the specific preparation conditions. Different electronic properties of these nanowires depending on the wiretype will be presented. In nanowire direction strongly dispersing bands are found crossing the Fermi energy, while also a slight dispersion in perpendicular direction will be discussed in detail. Hence dysprosium-silicide nanowires could be interesting for contacting devices in future nanocircuit technologies.

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O 29.12 Wed 14:30 P2

Electrochemically Fabricated Nanoscale Copper Wires: Investigation of Wire Morphology and Composition — •Thomas Koch[1,2], Sheng Zhong[1,2], Eberhard Nold[3], Torsten Scherer[2], Harald Roesner[2], Horst Hahn[2], Stefan Walheim[2], Mu Wang[4], and Thomas Schimmel[1,2] — [1]Institute of Applied Physics, University of Karlsruhe, D-76128 Karlsruhe, Germany — [2]Institute of Nanotechnology (INT), Forschungszentrum Karlsruhe, D-76021 Karlsruhe, Germany — [3]Institute for Materials Research I (IMF I), Forschungszentrum Karlsruhe, D-76021 Karlsruhe, Germany — [4]National Laboratory of Solid-State Microstructures, Nanjing University, Nanjing 21009, China

Metallic nanostructures, especially made from copper, have attracted considerable attention in recent years due to their potential use both as interconnects and as components for future generations of electronics. Here we report on the investigation of electrochemically self-assembled copper wires by SEM, TEM and SAMS. The wires were found to be straight, regular, without branches and more than 100 micrometer long. These wires align spontaneously to form ordered arrays, covering the insulated substrate in large numbers. The thickness of the wires can be controlled by the experimental parameters down to 120 nm. The SAMS results show that the investigated stable structures consist of pure copper. The TEM results point out that the wires consist of stacked single crystalline copper lamellae, which have a thickness of down to a few monolayers. The SAMS depth profiles show that the wires are surrounded by an oxide layer with a thickness of less than 15 nm.