MM 37: Nano structured materials V

Time: Thursday 16:45–18:00 Location: H4

MM 37.1 Thu 16:45 H4

Assembly of shape controlled nanocrystals at nanopatterned interfaces — •Eva Bock[1,2], Angela Fiore[3], Liberato Manna[3], and Joachim Spatz[1,2] — [1]Max-Planck-Institute for Metals Research, Dept. New Materials & Biosystems, Heisenbergstr. 3, 70569 Stuttgart, Germany — [2]University of Heidelberg, Dept. Biophysical Chemistry, INF 253, 69120 Heidelberg, Germany — [3]National Nanotechnology Laboratories of CNR, Via Arnesano, 73100 Lecce, Italy

Gold nanoclusters with diameters between 2 and 30 nm and lateral distances of 20 to 250 nm are arranged onto silicon or glass substrates with a uniform diameter and a defined interparticle spacing. The patterning technique is based on self-assembly of metal loaded diblockcopolymer micelles (poly[styrene-b-2-vinylpyridine(HAuCl4)]) which form a quasi-hexagonal close packed monolayer. The individual gold nanoparticles are potential candidates for immobilizing single molecules or nanoscopic objects. We developed different methods for the assembly of several nanoparticles on nanostructured surfaces. Nanocrystals of different shape and dimensions have been widely developed during the last decade due to their size- and shape-dependent optical, physical and magnetic properties. One method for the assembly of the nanoparticles is based on thiol-chemistry, the other is based on the hybridization of DNA-strands. For the second way the nanocrystals had first to be transferred from organic into aqueous solution.

This work describes an approach which allows for hierarchical organization of different nanocrystals at interfaces which in turn will allow for tuning its optical properties.

MM 37.2 Thu 17:00 H4

Functional surface nanostructures with highly-regular patterns, tunable properties and broad application potential — •Yong Lei and Gerhard Wilde — Institut für Materialphysik, Universität Münster, Wilhelm-Klemm-Str. 10, 48149 Münster, Germany

Using a new surface nano-patterning technique - the UTAM (ultra-thin alumina mask) nano-patterning, ordered arrays of zero-dimensional nanostructures (such as e.g. CdSe nanodots or Si nanoholes) and one-dimensional nanostructures (such as e.g. carbon nanotubes or Ni nanowires) were fabricated on flat substrates. The ordered nanoparticles and nanoholes were prepared using vacuum evaporation processes and focused-ion-beam etching, respectively. The carbon nanotube arrays were initiated from UTAM-prepared catalyst (metal) nanoparticle arrays in a PECVD process. The feature size of the UTAM-fabricated surface nanostructures can be adjusted in the range of about 10-200 nm. The advantages of the UTAM surface nano-patterning, such as the achievement of tunable properties, large pattern area, high throughput and low equipment costs, make the technique quite suitable to fabricate ordered surface nanostructures with a broad range of potential applications ranging from optics and electronics applications to fabricating nanoscale devices. 1. Y. Lei, et al., Chem. Mater. 17, 580 (2005). 2. Y. Lei, W. K. Chim, H. P. Sun, G. Wilde, Appl. Phys. Lett. 86, 103106 (2005). 3. Y. Lei, et al., Nanotechnology 16, 1892 (2005). 4. G. Wilde, Surface and Interface Analysis 38, 1047 (2006). 5. Y. Lei, W. P. Cai, G. Wilde, Prog. Mater. Sci., in press (2007).

MM 37.3 Thu 17:15 H4

Energy transfer via mechanical and thermal channels in metallic nano-objects arrays — •F Banfi[1], B Revaz[2], C Giannetti[2], G Ferrini[2], P Vavassori[3], V Metlushko[4], M Montagnese[2], F Cilento[2], G Coslovich[5], and F Parmigiani[5] — [1]Department of Condensed Matter Physics, University of Genève, Switzerland — [2]Dipartimento di Matematica e Fisica, Università Cattolica, Brescia, Italy — [3]Dipartimento di Fisica, Università di Ferrara, Italy — [4]Department of Electrical and Computer Engineering, University of Illinois at Chicago, IL — [5]Dipartimento di Fisica, Università degli Studi di Trieste, Italy

2D periodic arrays of permalloy nanodisks deposited on Si substrates are investigated with pump probe optical technique. The 150 fs pump beam (λ=800nm, repetition rate 80 MHz) is used as the excitation source, while the relaxation of the sample is measured recording the variation of intensity of the reflected probe beam as a function of the delay between the pump and probe pulses. The reflected intensity of the first-order diffracted beam is measured. The data show 1) a relaxation of the intensity with a time constant $\tau \sim$ ns 2) oscillations dominated by a frequency $\omega_0/2\pi$ in the GHz range with a damping rate γ. The energy is transfered from the nanodisk to the Si substrate both via thermal and mechanical energy fluxes, the measured time constant τ setting the timescale for these processes. Numerical simulations suggest that the contribution of the two energy channels to the relaxation time can be disentangle. This technique is therefore suitable to measure the specific heat of mesoscopic samples.

MM 37.4 Thu 17:30 H4

Nanoscale ablation induced by laser near-field — •Anton Plech[1], Vassilios Kotaidis[1], Maciej Lorenc[2], Konstantin Istomin[1], and Johannes Boneberg[1] — [1]Fachbereich Physik, Uni Konstanz, Universitätsstr. 10, D-78457 Konstanz — [2]ESRF, BP 220, F-38043 Grenoble; present address: GMCM, Universite Rennes 1, Bat. 11A, Campus Beaulieu, F-35042 Rennes

Experiments on femtosecond laser excited gold nanoparticles are presented and it is shown, that the structure formation of the particles is induced by a non-thermal ablation process, which is induced by the strong local enhancement of the laser field close to the particle surface [1]. Time-resolved x-ray scattering allowed to discriminate the structural manifestations of the excitation process, such as particle heating, melting and relaxation with the environment [2].

[1] A. Plech, V. Kotaidis, M. Lorenc, J. Boneberg: Femtosecond laser near-field ablation from gold nanoparticles, Nature Phys. 2 (2006) 44.

[2] V. Kotaidis, C. Dahmen, G. von Plessen, F. Springer, A. Plech: Excitation of nanoscale vapor bubbles at the surface of gold nanoparticles in water, J. Chem. Phys., 124, (2006) 184702.

MM 37.5 Thu 17:45 H4

SAXS charakterization of silver nanoparticles in glass — •Michael Leitner[1], Gerhard Seifert[2], Bogdan Sepiol[1], and Andrei Stalmashonak[2] — [1]Fakultät für Physik, Universität Wien, Strudlhofgasse 4, 1090 Wien — [2]Institut für Physik, Optik, Martin-Luther-Universitat Halle-Wittenberg, Hoher Weg 8, Halle (Saale)

Glass samples containing silver nanoparticles are of great interest to the optical community because of their special optical properties caused by surface plasmon resonance, resulting in absorption of characteristic wavelengths. Initially spherical particles of about 30 nm diameter can be transformed to ellipsoids by femtosecond laser irradiation in the visible range, which results in optical dichroism of the sample [1]. This method allows the production of high-temperature polarisators.

Here we present SAXS-measurements on the nanoparticles' size distribution and the shape perpendicular to the surface of the sample. The process of interest is as follows: the axis parallel to the polarisation of the laser and elongated at comparably low intensities of the laser shortens at high intensities. Moreover, we can validate the existence and the shape of holes in the matrix created by the dissolution of nanoparticles by a DC field. After the dissolution process no characteristic absorption is detectable any longer and the shape validation by optical means is impossible.

[1] M. Kaempfe, G. Seifert, K.-J. Berg, H. Hofmeister, H. Graener, Eur. Phys. J. D 16, 237-240 (2001)