

SYSO 3: Self-Organizing Surfaces and Interfaces - Posters

Time: Wednesday 17:30–19:30

Location: P3

SYSO 3.1 Wed 17:30 P3

Controlling Structural Properties of Self-Assembled Oligonucleotide - Mercaptohexanol Monolayers — ●KURT KUMMER¹, ALFRED KICK², MARTIN BÖNSCH², DENIS VYALIKH¹, MICHAEL MERTIG², and SERGUEI MOLODTSOV¹ — ¹Institute of Solid State Physics, Dresden University of Technology, D-01062 Dresden, Germany — ²BioNanotechnology and Structure Formation Group, Max Bergmann Center of Biomaterials and Institute of Materials Science, Technische Universität Dresden, D-01062 Dresden, Germany

We present results of our recent investigations on the chemical conditions for the formation of mixed self-assembled monolayers of thiol-modified oligonucleotides and mercaptohexanol deposited onto gold surfaces. Using high-resolution X-ray photoemission spectroscopy we found that the spatial density of DNA strands can be varied in a controlled manner within a wide range by the concentration of MgCl₂ in the immobilization buffer. We were also able to illuminate the question how the DNA probes affect the quality of the mercaptohexanol SAM more deeply. In particular, the use of aqueous instead of ethanolic mercaptohexanol solutions with a more moderate mercaptohexanol concentration is demonstrated to be favorable for the formation of high-quality mixed monolayers.

SYSO 3.2 Wed 17:30 P3

Chemical reactivity at surfaces induced by self organisation in ultrathin PEO films — ●EVELYN MEYER and BRAUN HANS-GEORG — Leibniz Institute of Polymer Research Dresden - Max Bergmann Center of Biomaterials, Dresden, Germany

The self organisation process that will be addressed is related to the crystallisation of Polyethyleneoxide (PEO) from amorphous ultrathin (3nm) PEO films. During crystallisation dendritic shaped lamellae crystals of PEO develop. Using appropriate short chain molecules (molecular weights in between 2000 and 6000) unfolded, or just 2 to 3 times folded lamella appear. During this process the surface chemistry of the material changes while the hidden endgroups of the amorphous state become enriched at the new created lamella surfaces. Using electron beam lithography we could attach the water soluble PEO lamellae to the surface. Using aminoendendgroups and fluorescence labelling we could demonstrate the strong increase in these endgroups as a consequence of the crystallisation process.

SYSO 3.3 Wed 17:30 P3

Self-organisation and orientation of 1-Palmitoyl-2-Oleoyl-sn-Glycero-3-Phosphocholin (POPC) at the surface of hydroxypropionitrile — ●HARTWIG POHL¹, THOMAS KREBS², STEFAN KREYSLER¹, and HARALD MORGNER¹ — ¹Leipzig University, Wilhelm-Ostwald-Institute for Physical and Theoretical Chemistry, Linnéstr. 2, D-04103 Leipzig — ²University of Wisconsin, Chemistry Department, 1101 University Ave, Madison, WI 53706

The understanding of the self-organisation of lipids at the surface of polar liquids is of great interest in biochemical as well as in technical topics. In order to gain information about the surface structure of POPC in hydroxypropionitrile, we have performed investigations using various particle spectroscopies, including metastable induced electron spectroscopy [H Morgner 2000 Adv. At. Mol. Opt. Physics 42B 387-488], XPS and ISS. Recent ARXPS-data suggest that at low concentrations the polar head groups are located at the surface, rather than the hydrophobic chains [F Knoll 2001 PhD-thesis University Witten-Herdecke]. This is supported by investigations with NICISS [T Krebs 2006 PhD-thesis Leipzig University]. With increasing surface excess the relative position between both elements approaches the expected order. In order to gain additional information on the surface structure, we have employed the perfectly surface sensitive electron spectroscopy MIES that characterizes exclusively the topmost layer of the liquid. As we suspect the asymmetric structure of POPC to play an important role, the behaviour of the analogues DPPC and DOPC in HPN is investigated by MIES as well.

SYSO 3.4 Wed 17:30 P3

Dynamics of a drop on oscillated substrate: the role of contact line hysteresis — ●IRINA S. FAYZRAKHMANOVA¹ and ARTHUR V. STRAUBE² — ¹Department of Theoretical Physics, Perm State University, Bukirev 15, 614990 Perm, Russia — ²Department of Theoretical

Physics, TU Berlin, Hardenbergstr. 36, 10623 Berlin, Germany

The dynamics of a drop sitting on the transversally oscillated substrate is under theoretical consideration. We aim at understanding the impact of the contact angle hysteresis, which is described by means of the dynamic boundary condition suggested by Hocking [1]: the contact line starts to move only when the deviation of the contact angle exceeds a certain critical value. As a result, the system is able to demonstrate stick-slip motion. Because of the dissipation at the contact line, the regime with steady nonlinear oscillations with the frequency of external driving (or in other words the limit cycle) is reached. By comparing the results with the non-hysteretic situation, we figure out how the hysteresis affects the dynamics. Particularly, we analyze the amplitude dependencies on governing parameters and obtain resonance conditions.

[1] L.M. Hocking, Waves produced by a vertically oscillating plate, *J. Fluid Mech.* **179**, 267 (1987).

SYSO 3.5 Wed 17:30 P3

Observation of prewetting transitions at surfactant-laden liquid-crystal/water interfaces — ●CHRISTIAN BAHR — MPI for Dynamics and Self-Organization, Bunsenstr. 10, D-37073 Göttingen

Fundamental arguments [1,2] predict for systems possessing a first-order wetting transition at coexistence, that first-order surface transitions should exist also off coexistence. These prewetting transitions are characterized by a discontinuous finite change of the thickness of the wetting film.

We have recently studied [3,4] the wetting behavior of thermotropic liquid crystals at surfactant-laden interfaces to aqueous phases. The wetting film at the interface consists in this case of a thin ordered (nematic or smectic) film which exists at temperatures where the bulk phase is in the disordered (isotropic) state. A significant advantage of the liquid-crystal/water systems is, that the strength of the ordering surface field can be controlled via the concentration of the surfactant. Careful tuning of the surfactant concentration should enable the experimental realization of prewetting transitions. In this study, we report first measurements confirming the existence of prewetting transitions in a nematic wetting film at such interfaces.

[1] J. W. Cahn, *J. Chem. Phys.* **66**, 3667 (1977).

[2] H. Nakanishi and M. E. Fisher, *Phys. Rev. Lett.* **49**, 1565 (1982).

[3] Ch. Bahr, *Phys. Rev. Lett.* **99**, 057801 (2007).

[4] E. Kadivar, Ch. Bahr, and H. Stark, *Phys. Rev. E* **75**, 061711 (2007).

SYSO 3.6 Wed 17:30 P3

Dewetting of colloidal solutions: Kinetic Monte Carlo model vs. Dynamical Density Functional Theory — IOAN VANCEA¹, MARK ROBBINS¹, ANDREW ARCHER¹, ●UWE THIELE¹, ANDREW STANNARD², EMMANUELLE PAULIAC-VAUJOUR², CHRISTOPHER MARTIN², MATTHEW BLUNT², and PHILIP MORIARTY² — ¹Department of Mathematical Sciences, Loughborough University, UK — ²The School of Physics and Astronomy, University of Nottingham, UK

We employ a kinetic Monte Carlo (KMC) model [1-3] and a Dynamical Density Functional Theory (DDFT) [4] to model the evaporative dewetting of a nanoscopic precursor film of nanoparticle solution that stays behind a mesoscopic convective dewetting front [2,5]. With the KMC model we study the influence of the particles on (i) spinodal dewetting and nucleation processes, and (ii) the transverse instability of the dewetting front. The DDFT describes the dynamics of both - nanoparticle and liquid - densities. As compared to the purely 2d KMC it allows to model the evaporation/condensation of the solvent and its transport within the layer. The theories are compared in the spinodal and metastable parameter region as well as for unstable dewetting fronts.

[1] E. Rabani et al, *Nature* **426**, 271 (2003)

[2] C. P. Martin et al, *Phys. Rev. Lett.*, **99** 116103 (2007)

[3] I. Vancea et al, *Phys. Rev. E*, **78** 041601(2008)

[4] A.J. Archer, M. J. Robbins and U. Thiele, in preparation

[5] E. Pauliac-Vaujour et al, *Phys. Rev. Lett.*, **100** 176102 (2008)

SYSO 3.7 Wed 17:30 P3

Thin Film Model for Evaporating Colloidal Suspensions — ●LUBOR FRASTIA, ANDREW J. ARCHER, and UWE THIELE — Depart-

ment of Mathematical Sciences, Loughborough University, Loughborough, Leicestershire, LE11 3TU, UK

Based on long-wave approximation [1,2], we introduce a model for an evaporating film or drop of a colloidal suspension. Some basic assumptions regarding the various transport processes that are involved (convection, diffusion, evaporation) are used as well. We use the resulting system of coupled evolution equations to study the evaporation of drops on a solid substrate. Finally, we discuss the conditions for the self-pinning of the receding contact line that may result in the deposition of a dried-in ring of particles.

[1] S.Kalliadasis, U.Thiele, *Thin films of Soft Matter*, Springer Wien, p.25-94 (2007)

[2] A.V.Lyushnin, A.A.Golovin, L.M.Pismen, *Phys. Rev. E* 65, 021602, (2002)

SYSO 3.8 Wed 17:30 P3

Polymer brushes as self-organized surfaces — ●JENS-UWE SOMMER¹, HOLGER MERLITZ^{1,2}, and GUI-LI HE³ — ¹Leibniz Institute of Polymer Research, Hohe Strasse 6, D-01069 Dresden, Germany — ²Department of Physics and ITPA, Xiamen University, Xiamen 361005, P.R. China — ³Institut für Theoretische Physik II, Heinrich-Heine-Universität Düsseldorf, 40225 Düsseldorf, Germany

We propose a novel principle to build reversibly switchable polymer brushes based on molecular dynamics simulations. Here we use the interplay between the sharp concentration profile of densely grafted brushes and the effect of modified end-groups. We show that bulky end-groups display a strong tendency to localize on top of the polymer brush ("active" state of the coating). When the environment is changing to disfavor the end-groups (exposed to poor solvent), however, they retreat into the brush layer which turns the coating into a "passive" state. At high grafting densities the chains are highly stretched and the entropic difference between the active (stretched) and the passive (coiled) state is large leading to a sharp transition by changing the parameters of the environment (temperature, solvent quality) thus leading to an efficient switching behavior.

SYSO 3.9 Wed 17:30 P3

Viscosity and density at the polymer-solid interface — ●E.TILO HOPPE, ALEXANDRA MÜNZER, and CHRISTINE M. PAPADAKIS — TU München, Physikdepartment E13, Garching

Close to the interface between a polymer film and a solid the polymer properties deviate from the bulk. This change in physical behaviour is of importance for the adhesion of polymer coatings to solids, e.g. in medical implants or in paints.

The goal of the project is the investigation of the influence of the polymer-solid interaction on the physical properties of the polymers near the interface. Special interest is dedicated to the correlation in change of density and viscosity of the polymer near the interface. Low molecular weight polybutadiene melt on silicon oxide is studied as a model system. The changes in density and viscosity are investigated by neutron reflectometry and fluorescence correlation spectroscopy. To tune interface interactions between substrate and polymer melt, different substrate surface modifications have been applied and their surface tension components were determined with contact angle measurements.

SYSO 3.10 Wed 17:30 P3

Multiscale study of crystallization in diblock copolymer thin films at different supercooling — ●CHRISTINE M. PAPADAKIS¹, CHARLES DARKO¹, EZZ METWALI¹, IOAN BOTIZ², GÜNTER REITER², DAG W. BREIBY³, JENS W. ANDREASEN⁴, STEPHAN V. ROTH⁵, and DETLEF-M. SMILGIES⁶ — ¹TU München, Physikdepartment E13, Garching — ²Institut de Chimie de Surfaces et Interfaces, CNRS, Mulhouse, France — ³Department of Physics, Norwegian University of Science and Technology, Trondheim — ⁴Risø National Laboratory, Roskilde, Denmark — ⁵HASYLAB at DESY, Hamburg — ⁶CHESS, Cornell University, Ithaca NY, USA

In block copolymers with a crystalline block, the orientation of the crystalline chain stems with respect to the internal interfaces depends on the degree of supercooling. The thin film geometry offers the possibility to create oriented mesostructures and to gain detailed knowledge on the crystalline orientation. We have studied thin films of polystyrene-*b*-poly(ethylene oxide), PS-*b*-PEO, diblock copolymers in dependence on the degree of supercooling. AFM showed that the crystalline domains (lamellae) consist of grains, which are macroscopic at a low degree of supercooling, but of submicrometer size for strong super-

cooling. Using grazing-incidence wide-angle X-ray scattering, we could determine the grain orientation distribution function which shows that the chain stems are perpendicular to the lamellae at low supercooling, but tilted at strong supercooling. These results suggest that, at strong supercooling, the crystalline PEO lamellae do not grow homogeneously, but by the formation of small crystallites at the growth front.

SYSO 3.11 Wed 17:30 P3

Breakout crystallization in cylinder-forming diblock copolymer thin films — ●CHRISTINE M. PAPADAKIS¹, CHARLES DARKO¹, KORDELIA TROLL¹, ZHENYU DI¹, STEPHAN FÖRSTER², DETLEF-M. SMILGIES³, and ANDREAS TIMMANN⁴ — ¹TU München, Physikdepartment E13, Garching — ²Universität Hamburg, Department Chemie — ³CHESS, Cornell University, Ithaca NY, USA — ⁴HASYLAB at DESY, Hamburg

In thin polymer films, crystallization often leads to fascinating surface structures. We have investigated the long-term behavior of the crystallization in thin films of cylinder-forming poly(isoprene-*b*-ethyleneoxide), PI-*b*-PEO. Using optical microscopy, AFM, X-ray reflectometry and grazing-incidence wide- and small-angle X-ray scattering, we have observed breakout crystallization of the PEO. The crystallization of the film was complete only after 150 days. The original hexagonal morphology was destroyed by crystalline lamellae lying in the film plane. The PEO chain stems were perpendicular to the film plane.

SYSO 3.12 Wed 17:30 P3

Formation of lateral structures in thin diblock copolymer films by vapor treatment — ●CHRISTINE M. PAPADAKIS¹, PETER ČERNOCH², PETR ŠTĚPÁNEK², DETLEF-M. SMILGIES³, and STEPHAN V. ROTH⁴ — ¹TU München, Physikdepartment E13, Garching — ²Inst. Macromolecular Chemistry, Prague, Czech Republic — ³CHESS, Cornell University, Ithaca NY, USA — ⁴HASYLAB at DESY, Hamburg

Exposure of block copolymer thin films to solvent vapor allows to control the orientation of the mesostructure with respect to the film surface. Using grazing-incidence small-angle X-ray scattering (GISAXS), we have investigated the structural changes in thin films of lamellae-forming poly(4-octylstyrene-*b*-butylmethacrylate) [1] before and after exposure to solvents of different qualities and selectivities and have found that the treatment with the strongly selective solvent acetone results in the parallel orientation, whereas the weakly selective solvent cyclohexane (CHX) leads to the formation of perpendicular lamellae, thus a laterally structured film. In-situ, real-time GISAXS during swelling with saturated CHX vapor revealed that the lamellar reorientation takes place within the first 15 min of the swelling. The film thickness nearly doubles. Upon drying, the lateral structure is preserved, i.e. treatment with this solvent constitutes an attractive opportunity to induce lateral structures in thin block copolymer films.

1. P. Černoch, P. Štěpánek et al., *Eur. Polym. J.* 43, 1144 (2007).

SYSO 3.13 Wed 17:30 P3

Influence of Polymers on polarizability and structure of microemulsion droplets — ●ROBERT WIPF, SEBASTIAN JAKSCH, BERND STÜHN, and BJÖRN KUTTICH — TU Darmstadt, Experimentelle Physik kondensierter Materie, 64289 Darmstadt, Germany

Water-in-oil microemulsions are thermodynamically stable mixtures of water droplets in a continuous oil phase. The droplets are stabilized by a monomolecular layer of amphiphilic surfactant molecules. The investigated microemulsion consists of water and decane with sodium bis(2-ethylhexyl)sulfosuccinate (AOT) as ionic surfactant. We determine the structure of this system by SAXS showing spherical structure. The conductivity of such systems exhibits a steep increase when volume fraction or temperature increase above a critical value. This behavior can be understood as dynamic percolation. In the dielectric spectrum of a microemulsion, as a heterogeneous system, an interfacial polarization, known as Maxwell-Wagner-Sillars effect, was observed. In the high frequency regime a further relaxation occurs, which can be attributed to the sodium and AOT moiety ions. This relaxation depends strongly on the water content of the droplets as well as their interaction. Adding PEO to the water core leads to an extra polymer shell on the inner side of the droplet interface. Its influence on percolation temperature and structure can be observed by dielectric spectroscopy and SAXS. Adding the amphiphilic triblock copolymer PEO-PI-PEO at low droplet volume fraction decorates the droplets. This decreases attractive interaction among the droplets as we observe in dielectric and SAXS measurements.

SYSO 3.14 Wed 17:30 P3

STM STUDY OF SELF-ASSEMBLY AT THE SOLID-LIQUID INTERFACE CONTROLLED BY THE CONCENTRATION OF SOLVED MOLECULES — ●THI NGOC HA NGUYEN

Reichenhainer Strasse 70 Physik-Neubau 09126 Chemnitz

Trimesic acid (TMA) is known to assemble in diverse supramolecular structures due to the three fold - symmetric carboxylic acid functionality for the formation of hydrogen-bond networks since they can act as both H-bond donor and acceptor at the same time, and therefore can bind to themselves in any conformation. The solvent chosen in this experiment is octanoic acid. According to (1), TMA in this solvent can only form chicken-wire structure. But, we found that, depending on concentration of TMA in octanoic acid, that there are also other structures. We made different solutions with the same amount of solute (TMA) and solvent (octanoic acid) but different concentration of solved TMA by different sonication time

SYSO 3.15 Wed 17:30 P3

Probing electronic states of double layered molecules in a STM junction — ●FRANCESCA MATINO¹, GUILLAUME SCHULL¹, MARCO KNUTZEN¹, SANDRO GABUTTI², MARKUS NEUBURGER², MARCEL MAYOR², and RICHARD BERNDT¹ — ¹IEAP-Universität Kiel, Kiel, Germany — ²University of Basel, Basel, Switzerland

In recent years, electron transport through single molecules has become a key issue for molecular electronics. It is known that the electronic coupling between molecules and metallic electrode can affect the transport behaviour, so thin insulating layers are often used to decouple molecules and keep their properties unaltered. A promising alternative are cyclophanes, upright 3D-structures consisting of layered π -systems bridged with aliphatic chains, where the upper π -system is far away from the surface. We have used a UHV low temperature-STM to study the electronic properties of double layered conjugated molecule on metal surface. We report on the organisation and molecular properties of a single and a double layered naphthalenediimide on Au (111) surface. We focus on the influence of metal surface on the electronic states of both molecules as well as the interaction between the separate π -layer, in order to validate the electronic decoupling capability of cyclophanes on surface.

SYSO 3.16 Wed 17:30 P3

Growth kinetics of oligo-ethylene glycol thiols on Au-surfaces - Real-time IR studies under aqueous conditions — ●STEFAN ZORN¹, NATHAN MARTIN², ALEXANDER GERLACH¹, and FRANK SCHREIBER¹ — ¹Institut für Angewandte Physik, Universität Tübingen, Tübingen, Germany — ²Montana State University, Bozeman, MT, USA

Oligo-ethylene glycols (OEGs) are an important model system for biotechnological applications. In particular OEG SAMs are able to form protein resistant surfaces. The underlying mechanism of this property is not fully understood until now. However, recent investigations indicate that solvent interaction with the OEG layer plays an important role in the capacity to withstand protein absorption [1].

While n-alkane SAM growth has been intensively studied [2], only little is known about OEG SAM growth kinetics, although the structure of the OEGs including their confirmation and defects is crucial for their performance in protein resistance. Using a polarisation modulation infrared reflection absorption spectroscopy (PMIRRAS) setup with a home made liquid cell we were able to monitor the different stages of growth and identify the different conformations of the OEG SAM dependent on the surface coverage. By comparing the absorption bands in the region of the strong C-O-C stretching mode we were also able to describe the underlying growth kinetics and to model the changing ratio of all-trans and helical conformation during growth.

[1] M.W.A. Skoda et al., Langmuir 23 (2007) 970.

[2] F. Schreiber, Prog. Surf. Sci. 65 (2000) 151.

SYSO 3.17 Wed 17:30 P3

Nano-Diamantdrähte: Fabrikation und Charakterisierung für Anwendungen in der Elektrochemie — ●WALDEMAR SMIRNOV, ARMIN KRIELE, MARCO WOLFER und CHRISTOPH E. NEBEL — Fraunhofer-Institut Angewandte Festkörperphysik, Tullastrasse 72, Freiburg 79108, Deutschland

Chemische und biochemische Sensoren der nächsten Generation erfordern signifikante Verbesserungen in Sensitivität, chemischer Stabilität und Bio-Kompatibilität, um zukünftige Bedürfnisse in diversen Anwendungen zu erfüllen. Seit einiger Zeit stehen vertikal ausgerichtete

Nano-Drähte aus Diamant zur Verfügung. Diese sollten herausragende chemische Beständigkeit und elektrochemische Eigenschaften aufweisen, die bisher jedoch noch nicht charakterisiert wurden.

In diesem Vortrag wird die Herstellung von vertikal ausgerichteten Nano-Diamantdrähten aus Bor- und undotiertem Diamant vorgestellt. Die Drähte werden mittels eines ICP-Trockenätzverfahrens hergestellt, unter Verwendung von selbstorganisierten Nickelpunkt-Ätzmasken. Diese werden durch Aufdampfen einer dünnen Nickelschicht (ca. 1 nm) realisiert, die bei 700°C getempert wird. Durch Stranski-Krastanov Wachstum kommt es dabei zur Ausbildung von Nickelinseln mit ca. 17 nm Durchmesser, die sich homogen verteilt auf der Oberfläche anordnen. Diese wirken als Ätzmaske im anschließenden Plasmaätzschritt (ICP). Die entstehenden Diamantdrähte weisen ein Aspektverhältnis von 18 auf. Die Eigenschaften der Drähte werden durch SEM, STM, AFM, IU und Mikro-Raman Experimente analysiert und in diesem Vortrag vorgestellt.

SYSO 3.18 Wed 17:30 P3

Probing the elastic properties of individual nanostructures by combining in-situ AFM and micro X-ray Diffraction —

●TILL H. METZGER¹, THOMAS SCHELER¹, THOMAS CORNELIUS¹, ROGERIO PANIAGO¹, MARIO RODRIGUES², CRISTIAN MOCUTA¹, ANGELO MALACHIAS¹, JOEL CHEVRIER², and FABIO COMIN¹ — ¹European Synchrotron Radiation Facility (ESRF), B.P. 220, 38043 Grenoble Cedex, France — ²Institut Néel, CNRS-UJF, B.P. 166, 38042 Grenoble Cedex 9, France

Atomic Force Microscopy (AFM) and micro X-ray Diffraction (micro-XRD) are combined to investigate nanostructures during in-situ indentation. This technique allows the determination of elastic properties of individual nanoscale objects, particularly here SiGe/Si(001) self-assembled islands. Using this novel technique it was possible to select a specific island, align it in the microfocused beam and apply a pressure onto it, using the AFM tip. Simultaneously, the X-ray diffuse scattering map from the island and the surrounding substrate was recorded in order to probe the lattice parameter change during indentation. An elastic reduction of the island lattice parameter of up to 0.6% was achieved.

SYSO 3.19 Wed 17:30 P3

Influence of molecule adsorption on the surface electric fields of GaAs(001)c(4x4) and (2x4) — ●T. BRUHN^{1,2}, R. PASSMANN^{1,2}, B.O. FIMLAND³, M. KNEISSL¹, N. ESSER^{1,2}, and P. VOGT¹ — ¹TU Berlin, Institut für Festkörperphysik, Hardenbergstr.36, 10623 Berlin, Germany — ²ISAS Berlin, Albert-Einstein-Str.9, 12489 Berlin, Germany — ³NUST, NO-7491 Trondheim, Norway

Organic/inorganic interfaces have been attracting a growing interest over the last years. Particularly the affection of surface electric fields due to molecular adsorption could open up perspectives for novel sensor concepts. For these purposes a profound understanding of the atomic and electronic properties of the interface formation is required.

In our experiments we have been investigating the interface between different the GaAs(001)c(4x4) and (2x4) surface reconstructions and self-assembled monolayers of small organic ring molecules (Cyclopentene (C₅H₈) and 1,4-Cyclohexadiene (C₆H₈)). The samples were prepared in UHV and investigated with reflectance anisotropy spectroscopy (RAS) and soft x-ray photoelectron spectroscopy (SXPS).

After the chemisorption of the molecules a significant influence on the linear electro-optic effect (LEO) could be observed. This influence could be shown to also depend on the substrate doping level. On both substrate surface reconstructions photoemission spectra of the Ga 3d and As 3d core levels exhibit a different influence on the surface band bending. These results can be explained by an affection of reconstruction induced piezo-electric fields due to the molecule adsorption.

SYSO 3.20 Wed 17:30 P3

Molecular arrangement of self-assembled Metal-Phthalocyanine on GaAs(001) — ●L. RIELE¹, R. PASSMANN^{1,2}, V. RACKWITZ¹, T. BRUHN^{1,2}, B.-O. FIMLAND³, M. KNEISSL¹, N. ESSER^{1,2}, and P. VOGT¹ — ¹TU Berlin, Institut für Festkörperphysik, Hardenbergstr.36, 10623 Berlin, Germany — ²ISAS Berlin, Albert-Einstein-Str.9, 12489 Berlin, Germany — ³NUST, NO-7491 Trondheim, Norway

Phthalocyanines have proved to be important materials for sensing applications such as chemical sensors. Therefore it is the major interest to profoundly understand the structural and electrical properties of such organic/inorganic hybrid systems.

Here we report on non-planar lead phthalocyanine (PbPc) deposited

on the three main GaAs(001) reconstructions, i.e. $c(4 \times 4)$, (2×4) and (4×2) . The samples were prepared under UHV conditions and investigated in terms of their interfacial atomic optical and chemical structure.

Our previous results showed an anisotropic molecular arrangement within 20 nm thick PbPc films depending on the initial GaAs(001) substrate surface reconstruction. By using scanning tunneling microscopy (STM) the initial deposition steps and molecular arrangement are here investigated on self-assembled submonolayer coverages of PbPc on GaAs(001). These results help to elucidate how the arrangement of the adsorbed PbPc molecules within the first monolayer is influenced by the atomic configuration of the GaAs substrate.

SYSO 3.21 Wed 17:30 P3

Infrared studies of Pb nanowires on silicon vicinal surfaces — ●CHUNG HOANG, ROBERT LOVRINCIC, MARKUS KLEVENZ, FRANK NEUBRECH, and ANNEMARIE PUCCI — Kirchhoff-Institut für Physik der Universität Heidelberg, Im Neuenheimer Feld 227, 69120 Heidelberg

By means of polarized infrared (IR) spectroscopy we investigate the optical response of self-assembled lead nanowires growing on silicon vicinal surfaces. Under IR excitation polarized parallel to the long wire axis we see a shift of a resonance frequency to lower wave numbers when the nanowires are growing in length, meanwhile there is no significant change observed with perpendicular excitation. The different behaviour of the nanowires under polarized IR electrical field reveals surface plasmon excitation and resonant enhancement of the local field. This field enhancement is known to be localized at the tip-ends of the nanowires and it can be exploited, for example, via an optical nanoantenna concept. As the formation of lead nanowires is defined from the very beginning stage of the nucleation process and is related to the anisotropy of terrace and corner-rounding diffusion, we use Si(335) and Si(557) vicinal substrates with and without gold decoration as one-dimensional templates for producing various arrays of parallel nanowires for comparison. Our result demonstrates that the stability of the vicinal surfaces and also corner-rounding diffusion play key roles in the formation of the nanowires. The influence of the substrate temperature on the development and resonance frequencies of the nanowires is also studied.

SYSO 3.22 Wed 17:30 P3

Towards a molecularly thin Ferroelectric-OFET: surface modification of ferroelectric PZT films mediated through functionalized thiophene derivatives — ●KINGA HAUBNER^{1,2}, PETER MILDE¹, EVELIN JAEHNE², DENNY KOEHLER¹, ULRICH ZERWECK¹, and LUKAS ENG¹ — ¹Institute of Applied Photophysics, Technische Universität Dresden, 01062 Dresden, Germany — ²Institute of Macromolecular Chemistry, Technische Universität Dresden, 01062 Dresden, Germany

Lead zirconate titanate (PZT) has been used as the substrate material of choice for designing an ultrathin ferroelectric gate electrode in an organic field-effect transistor (Ferro-OFET). The focus of the present work is on the film formation process of the molecularly thin organic conduction layer based on α,ω -dicyano- β,β^* -dibutylquaterthiophene (DCNDBQT). Film formation is effectively promoted through specifically designed, bifunctional self-assembling molecules which act as a template layer. We report on nanoscale investigations of the film structure using a combination of X-ray photoelectron spectroscopy (XPS), ellipsometry and non-contact atomic force microscopy (nc-AFM) in combination with Kelvin probe force microscopy (KPFM). Excellent properties were found for those films prepared through in-situ UHV sublimation and analysis. Our measurements indicate that the DCNDBQT molecules form a well-ordered closed packed, dense, and terraced molecular layer exhibiting step heights in the range of approximately 2.0 nm. Therefore, such organic monolayers are well suited as the conduction layer in ultrathin ferroelectric OFET-structures.

SYSO 3.23 Wed 17:30 P3

Sputter Deposition of Aluminium on Colloidal Polymer Templates — ●RAINER GEHRKE¹, GERD HERZOG^{1,2}, ADELIN BUFFET¹, SEBASTIEN COUET¹, KAI SCHLAGE¹, GUNAR KAUNE³, VOLKER KÖRSTGENS³, ROBERT MEIER³, EZZELDIN METWALLI³, STEPHAN V. ROTH¹, RALF RÖHLSBERGER¹, WILFRIED WURTH², and PETER MÜLLER-BUSCHBAUM³ — ¹HASYLAB at DESY, Notkestr. 85, D-22607 Hamburg, Germany — ²Inst. f. Exp. Phys., Univ. Hamburg, Luruper Chaussee 149, D-22761 Hamburg, Germany — ³TU München, Physik-Department, James-Frank-Str. 1, D-85747 Garch-

ing, Germany

This work addresses an approach to the formation of metal nanowire meshes on surfaces. Colloidal dispersions of 100 nm polystyrene spheres were spincoated on silicon. Islands of packed layers of spheres were formed which served as template for sputter deposition of aluminium. Structure formation was investigated with grazing incidence small angle X-ray scattering at beamline BW4 at HASYLAB/DESY using an in-situ sputtering chamber, thus scattering could be observed during metal deposition. The measurements indicate, that at the beginning of the deposition the metal atoms assemble in the indentations between the spheres, only after longer sputtering times the surface becomes completely covered with aluminium. If an unspattered sample was heated beyond the glass transition temperature the lateral ordering vanished, if sputtering was stopped before complete metal coverage ordering remained upon heating. This indicates that the metal forms a stable structure separating the polymer spheres from each other.

SYSO 3.24 Wed 17:30 P3

DFT-study of the adsorption of organic molecules on low-index titanium dioxide surfaces — REGINA LUSCHTINETZ¹, ANDREY N. ENYASHIN^{1,2}, THEODOR MILEK¹, JOHANNES FRENZEL^{1,3}, ●SIBYLLE GEMMING³, and GOTTHARD SEIFERT¹ — ¹Theoretische Chemie, TU Dresden, D-01062 Dresden, Germany — ²Institute of Solid State Chemistry, 620041, GSP-145, Ekaterinburg, Russia — ³Forschungszentrum Rossendorf, P.O. 51 01 19, 01314, Dresden, Germany

The adsorption of small (bio-)organic molecules on clean, low-index TiO₂ surfaces has been investigated by density-functional based tight-binding calculations with the goal to rationalise the propensity of such molecules to self-assemble into row-like structures or two-dimensionally ordered patches. The systems studied range from phosphonic acids to the nucleotide cytidin monophosphate adsorbed on TiO₂ anatase(101) and rutile(110) surfaces. We studied the geometries and adsorption energies of several adsorption models and obtain several possible adsorption structures that can be present on the specific TiO₂ surfaces with comparable probability. For the pure phosphonic acids the preferable coordination is exclusively bidentate with similar adsorption energies but several different geometries. Monodentate and tridentate arrangements have significantly smaller adsorption energies and tend to relax towards the bidentate coordination. Despite the different steric situation, cytidin monophosphate exhibits exactly the same trends as phosphonic acids with bidentate coordination via a combination of oxo, alkoxy and hydroxyl groups.

SYSO 3.25 Wed 17:30 P3

Feedback effect on the self-organized structures formation upon femtosecond laser ablation — ●OLGA VARLAMOVA and JUERGEN REIF — LS Experimentalphysik II, Brandenburg University of Technology Cottbus and IHP/BTU JointLab Cottbus, Konrad-Wachsmann-Allee 1, 03046 Cottbus, Germany

Self-organized structures upon multi-pulse femtosecond laser ablation at intensities below the ablation threshold for a single pulse for CaF₂ and around the ablation threshold for Si are observed at the crater bottom. Numerous experimental data exhibit a positive feedback in the self-organization process. To investigate an influence of this effect on the formation of surface structures ablation experiments with variable pulse separation time have been performed on semiconductor (Si) and dielectric (CaF₂). By reducing laser repetition rate from 1000 Hz to 1 Hz we observe an exponential decrease of the ablated area on both samples. The results for Si show also an essential reduction of the pattern complicity as well as of their size in the centre of the ablation spot. We show that feedback becomes weaker with increasing time intervals between successive pulses. The nature of the feedback mechanisms will be discussed.

SYSO 3.26 Wed 17:30 P3

Systematical Structural Investigation of Self-Assembled Monolayers formed from Dithiolanes on Gold (111) — ●XIA STAMMER, ASIF BASHIR, CHRISTIAN HÜLSBUSCH, MARTIN KIND, and CHRISTOF WÖLL — Lehrstuhl für Physikalische Chemie 1, Ruhr-Universität Bochum, Universitätsstraße 150, D-44801 Bochum, Germany

Self-assembled monolayers (SAMs) have attracted considerable interest since they offer a huge potential for various applications including corrosion protection, nanoelectronics, biological compatibility of metal implants and other surface modifications. The most common

self-assembling molecules used for self-assembly on gold are thiols and disulfides, which have been extensively investigated in recent years. In order to improve the stability of thiol-based SAMs, we have investigated a new class of molecule, which contain two S-atoms per molecule. The formation and the structure of self-assembled monolayers of 4-alkane-1,2-dithiolane with different alkane chain length and Phenyl-dithiol on gold were explored. We have characterized these SAMs by contact angle goniometry (CA), infrared reflection absorp-

tion spectroscopy (IRRAS), scanning tunneling microscopy (STM) and X-ray photoelectron spectroscopy (XPS). IR-spectra of the isolated dithiolanes have been calculated using DFT. Overall, the 4-alkane-1,2-dithiolanes form a less crystalline film than alkanethiols of comparable chain lengths. However, the STM results of the phenyl-dithiol support well ordered and densely packed chelating molecules on the gold surface.