The Adsorption of Calcium on Regioregular Poly(3-Hexylthiophene) Studied by Microcalorimetry and X-Ray Photoelectron Spectroscopy

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Regioregular poly(3-hexylthiophene) (rr-P3HT) is a semiconducting polymer used in organic electronics (OLED, OFET). In such applications, the interface structure and the interaction strength between the polymer and the electrode (e.g. Ca) play a crucial role in the performance of the device. The energetics of the interface, which directly reflects the interactions strength between the polymer and the metal film, is not accessible by conventional surface science techniques, but can be studied using adsorption microcalorimetry. We present a microcalorimetric study of the adsorption of Ca onto freshly prepared and, via electron irradiation, damaged rr-P3HT films. Calorimetric measurements are supplemented by high-resolution XPS. The unusual combination of these complementary techniques leads to a new level of understanding of this technologically relevant interface. Financial support by the DAAD and the NSF is gratefully acknowledged.

Selective polymerization on laser patterned organic templates: Towards switchable surface structures — MARIEKE MATHIEU1, ALEXANDER FRIEBE2, STEFFEN FRANZKA2, MATHIAS ULBRICHT3, and NILS HARTMANN1

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Stimuli responsive polymer hydrogels provide a means to build up membranes with switchable pore structures [1]. Here we present results from experiments which aim at the fabrication of hydrogel nanostructures on planar surfaces. Native silicon wafers were coated with octadecylsiloxane monolayers and patterned following a photothermal routine creating structures down to 100 nm and below [2]. For secondary functionalization of the depleted lines the samples were etched in ammonium fluoride solution and coated with hexadecyanoacetic acid. Using N-hydroxysuccinimide (NHS) coupling chemistry this provides a means to bind biochemical compounds with primary amine groups. In order to test this functionality the samples were treated with NHS and dodecylamine.


Fabrication of multifunctional surface structures via laser patterning of silicon bound organic monolayers — BENJAMIN KLINGERBEL1, LUC SCHERES2, STEFFEN FRANZKA2, NILS HARTMANN1, and HAN ZUILHOF2

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Silicon substrates are widely used as platforms in many micro- and nanofabrication schemes, e.g. in order to build up functional organic templates. For this purpose suitable patterning and functionalization techniques are needed [1-2]. Here we present a facile routine which allows to fabricate multifunctional organic surface structures. H-terminated Si(111) samples were functionalized with 1-hexadecene and 1-hexadecyne, respectively. Laser patterning of the primary monolayer then was carried out following a photothermal routine creating structures down to 100 nm and below [2]. For secondary functionalization of the depleted lines the samples were etched in ammonium fluoride solution and coated with hexadecyanoacetic acid. Using N-hydroxysuccinimide (NHS) coupling chemistry this provides a means to bind biochemical compounds with primary amine groups. In order to test this functionality the samples were treated with NHS and dodecylamine.

were deposited on native silicon samples using the spin coating technique. Irradiation with a focused beam from an argon ion laser operated at a wavelength of 514 nm allows to locally remove the coating [2]. At a spot diameter of about 2.5 microns structures with lateral dimensions down to 400 nm were prepared. Most remarkably, however, partial removal can be carried out at incremental steps leaving a distinct number of bilayers behind. This offers an opportunity to build up discrete topographies, which could be used as 3D templates for the fabrication of multilevel architectures of nanoscopic components.


O 76.7 Thu 16:45 MA 043
Growth of phospholipid membrane systems on self-organized semiconductor templates — Gerald Trummer, Gregor Hlawacek, Daniel Pressl, and Christian Teichert — Montanuniversität Leoben, Austria

Here, we use atomic force microscopy (AFM) to study the formation of solid-supported lipid bilayers on a variety of nanofaceted self-organized SiGe films on Si(001) [1] and ion eroded semiconductor surfaces [2] in comparison to smooth Si(001) wafers. 1-Palmitoyl-2-Oleoylsn-Glycero-3-Phosphoethanolamine (POPE) and 1,2-Dipalmitoyl-sn-Glycero-3-Phosphocholine (DPPC) were used as model systems. The resulting film morphology and the change of surface roughness have been investigated as a function of initial roughness and morphology of the substrate. Phase imaging is used to distinguish between the soft lipid layers and the hard semiconductor substrate. On SiGe templates showing a dislocation network it was found that the ridge trench structures appearing at the surface guide the terrace edges of DPPC layers. When the lipid coverage is very low, 100 nm x 100 nm pits of lipid layers and the hard semiconductor substrate. On SiGe templates showing a dislocation network it was found that the ridge trench structures have been investigated as a function of initial roughness and morphology of the substrate. Phase imaging is used to distinguish between the soft lipid layers and the hard semiconductor substrate. On SiGe templates showing a dislocation network it was found that the ridge trench structures appeared at the surface guide the terrace edges of DPPC layers.


O 76.8 Thu 17:00 MA 043
High Frequency QCM Flow Cell with Enhanced Accuracy for Liquid and Biochemical Sensing — Brigitte Paula Sagmeister1, Hermann Ghuber2, and Reinhard Schwödiauer1 — 1Soft Matter Physics, Johannes Kepler University, Altenbergerstrasse 69, 4040 Linz, Austria — 2Institute for Biophysics, Johannes Kepler University, Altenbergerstrasse 69, 4040 Linz, Austria

Throughout the last twenty years, acoustic wave sensors have been proven to be an extremely sensitive and accurate device for a wide variety of physical, chemical and biochemical sensing applications. Systems based on thickness shear mode (TSM) quartz resonators, working in a liquid environment with resonance frequencies between 5 and 15 MHz, are already established for real-time measurements of biochemical interactions and commercially available on the market. The utilisation of high frequency fundamental (HFF) quartz resonators, with resonance frequencies up to 150 MHz (and beyond), could further improve the sensitivity of such systems by orders of magnitude. We present a fully biocompatible flow cell, designed for HFF quartz resonators which, in spite of their small size, can be removed and exchanged quickly and with ease. The system performance is evaluated and quantified by a number of experiments including various viscosity measurement of sugar based solutions, the detection of a BSA protein monolayer and other biochemical reactions. We further address some specific problems especially related to reusability and cleaning procedures.

O 76.9 Thu 17:15 MA 043
Preparation and Surface Characterisation of Thermally Deposited Ultrathin Ionic Liquid Films — Till Cremer1, Manuela Killian2, Claudia Kolbeck3, J. Michael Gottfried1, Peter Wasserscheid2, Florian Maber1, and Hans-Peter Steinrück1 — 1Lehrstuhl für Physikalische Chemie II, Universität Erlangen-Nürnberg, Egerlandstrasse 3, 91058 Erlangen — 2Lehrstuhl für Chemische Reaktionstechnik, Universität Erlangen

Due to their unique physico-chemical properties, ionic liquids (ILs) are promising candidates for many applications in electrochemistry, analysis, synthesis, separation and lubrication technology, and in catalysis. In surface science, ILs open up interesting new possibilities: Since most ILs exhibit negligible vapour pressures at room temperature, various surface science techniques that employ ultra-high vacuum can be applied, enabling detailed investigations of their surface chemical composition and electronic structure. Furthermore, at elevated temperatures, thermal evaporation of ILs takes place, providing a new way for the in-situ preparation of ultrathin IL films on planar substrates. In an angular dependent photoelectron spectroscopy (XPS) study we investigated imidazolium-based IL films of nanometer thickness, deposited on glass. For 1-ethyl-3-methylimidazolium bis(trifluoromethylsulfonyl)imide ([EMIM]+ [Tf2N]−), we were able to demonstrate that the initial film growth occurs via a bilayer structure, with the [Tf2N]− anions pointing away from the surface while the [EMIM]+ cations are oriented towards the surface.

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