CPP 14 Polymer physics at the surface

Zeit: Montag 16:30–17:45 Raum: TU C130

CPP 14.1 Mo 16:30 TU C130

Experiments with single molecules of polyelectrolytes at surfaces. — •Anton Kiriy, Ganna Gorodyska, Vera Bocharova, and Manfred Stamm — Leibniz-Institut für Polymerforschung Dresden e.V., Hohe Str. 6, 01069 Dresden

Single molecules of linear polyelectrolytes (such as poly(2-vinylpyridine or polystyrene sulfonic acid) and star-shaped block copolymers (polystyrene-poly(2-vinylpyridine) were imaged being deposited onto an atomically flat mica with the aid of atomic force microscopy. Their diverse conformational transitions were investigated (Kiriy, A. et al., JACS 2002, 13454). We also have developed the simple contrasting procedure to improve the AFM visualization of positively charged polyelectrolytes deposited on the substrates of relatively high roughness via counter ion exchange between Cl- anions and bulky hexacyanoferrate anions or negatively charged nanoclusters of Prussian Blue virtually without altering of the initial polymer conformation (Kiriy, A. et al., JACS 2003, 11202).

CPP 14.2 Mo 16:45 TU C130

MANIPULATION OF SINGLE POLYMER MOLECULES ON SOLID SUBSTRATES — •Nikolai Severin[1], Wei Zhuang[1], Jörg Barner[1], Alexei Kalachev[2], Evgeniy An[3], Viktor Ivanov[3], and Jürgen P. Rabe[1] — [1]Department of Physics, Humboldt University Berlin, Newtonstr. 15, D-12489, Berlin, Germany — [2]PlasmaChem GmbH, Rudower Chaussee 29, 12489, Berlin, Germany — [3]Chair of Physics of Polymers and Crystals, Physics Department , Moscow State University, Moscow 119992 , Russia

We report on the manipulation of single macromolecules on solid surfaces. The macromolecule-surface interaction was tuned with alkylated amphiphile molecules, which self-assemble on crystalline substrates like the basal plane of graphite into monolayers with head groups and alkyl tails phase separated into lamellae. These lamellae can serve as soft nanoscopic 'rails' along which the polymer orients. ds-DNA molecules with contour lengths of up to 2 micrometers have been moved as a whole in a single manipulation step on a layer of dodecylamine (1). The length distribution of the polymer molecules adsorbed on the 'nano-structured' surface is considerably different from the length distribution in solution, which we attribute to the entropy loss of the molecules stretched on the 'nano-rails'. We visualize the coil-globule transition of poly(sodium 4-styrenesulfonate) by trapping the over-all conformation in solution on the surface.

(1) Severin, N.; Barner, J.; Kalachev, A.A.; Rabe, J.P. Nano Letters 2004, 4, 577-579.

CPP 14.3 Mo 17:00 TU C130

Ultra-small angle X-ray scattering at colloidal crystals on prepatterned support — •Beate Reinhold[1], Thomas Geue[1], Ullrich Pietsch[1], and Peter Bösecke[2] — [1]Institut für Physik, Universität Potsdam, Am Neuen Palais 10, D-14469 Potsdam, Germany — [2]European Synchrotron Radiation Faciliy, 38043 Grenoble, France

Crystalline ordering of monodisperse colloidal spheres is of great interest for many technical applications. The aim we pursue is to build up ordered structures (2D and 3D) on patterned substrates. The aim we pursue is to build up ordered structures (2D and 3D) on patterned substrates. Therefore 400 - 1000 nm sized Polystyrene particles were deposited by Gravity Sedimentation onto a substrate that is pre-structured by a surface relief grating. Besides a characterization of the surface with AFM the 3D structure can only be investigated by Ultra Small Angle X-Ray Scattering at the ID2 beamline of ESRF, Grenoble. Actually we received information-rich scattering images of samples measured in reflection and transmission geometry. From these data we could deduce 2D ordering of the colloids. For the first time we performed time-resolved measurements; in particular we measured the scattering signal of colloidal solution in-situ after deposition onto the substrate. While the whole process of drying takes up to 5 hours essential changes appeared within a time window of 5 to 15 minutes. We found that the degree of ordering was higher in the liquid phase right before complete evaporation of solvent compared with the ordering in solid phase.

CPP 14.4 Mo 17:15 TU C130

Modification and imaging of surface charges on polymers using atomic force microscopy — •Andreas Kleiner[1], Sabine Hild[1], Othmar Marti[1], Armin Knoll[2], Bernd Gotsmann[2], Urs Dürig[2], and Johannes Windeln[2] — [1]Dept. of Experimental Physics, University of Ulm, 89069 Ulm — [2]IBM Research GmbH, Zurich Research Laboratory, CH-8803 Rüschlikon

The atomic force microscope (AFM) is widely used to investigate and modify mechanical properties of thin polymer films. Different static and dynamic modes like force curve measurements, Pulsed Force Mode or intermittent contact techniques apply certain amounts of normal and lateral forces to the sample. This implies the possibility to create surface charges, similar to the macroscopic contact electrification of insulators. These charges can be imaged in the 'Surface Potential' or 'Kelvin Probe Force' mode of the AFM. The quantity of charge depends on parameters like contact time, force or velocity. By an additional tip voltage during contact, the amount and polarity of the surface charges can be influenced. The long-term stability of these charges, measured on different polymers, will be also shown in this work.

CPP 14.5 Mo 17:30 TU C130

AFM studies on nanostructure of sol-gel materials doped with photosensitive compounds — •Halina Podbielska[1,2], Marta Kopaczynska[3], Agnieszka Ulatowska-Jarza[1,4], and HansJ. Eichler[2,4] — [1]Bio-Optics Group, Institute of Physics, Wroclaw University of Technology, Wybrzeze Wyspianskiego 27, PL-50370 Wroclaw, Poland — [2]Institute of Optics, Technical University Berlin, Strasse des 17 Juni 135, D-10623 Berlin, Germany — [3]Institut für Chemie - Organische Chemie Freie Universität Berlin, Takustr. 3, 14195 Berlin — [4]Laser-und Medizin-Technologie Berlin, Fabeckstr. 60-62, D-14195 Berlin, Germany

Silica sol-gels are porous bodies made from liquids. It is possible to entrap various compounds in the porous sol-gel network. The aim of this work is to examine the structural properties of sol-gel matrices doped with photosensitive dyes. Our idea is to construct a special light applicator which can act simultaneously as carrier for photosensitive dye for PDT. Two photosensitizers were examined: natural porphyrine Protoporhyrine IX and chlorophyll based Photolon. The sol-gel films were prepared from silicate precursor TEOS mixed with ethanol in acid catalyzed hydrolysis,with different ratios R (20, 32, 40) denoting the number of alcohol moles to to the number of TEOS moles. Pure and doped films were studied by means of AFM. It was stated that nanostructure of sol-gels depends on R ratio. It was proved that there are open pores enabling the contact of photosesnitizers with external environment and the immobilization in sol-gels do not alter the structure of photosensitive dyes.