

terials placed on the opposite ends of the template pores.

We prepared gradient nanotubes by the use of PMMA and a fluorescent PMMA/9-Vinylanthracene copolymer. The gradient is formed at the point of contact of the two polymers. Another way to prepare gradient nanotubes is to use a mixture of polystyrene and a fluorescent dye (here: DANS) on the one side and polystyrene on the other side of the template pores. In this case the gradient is formed by diffusion of the dye into the polymer. The gradient nanotubes were investigated by fluorescence microscopy.

The gradient nanotubes can be used for graded-index optical fibers or waveguides and gradients in the surface-energy can be used to direct fluids on a given path.

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Unexpected preparative effects on the properties of thin polymer films — ●ANATOLI SERGHEI¹, HEIKO HUTH², CHRISTOPH SCHICK², and FRIEDRICH KREMER¹ — ¹University of Leipzig, Institute for experimental physics I, 04103 Leipzig, Germany — ²University of Rostock, Physics Department, , 18051 Rostock, Germany

Thin supported PS films dewet a solid substrate when kept above T_g in vacuum (~ 3 mbar), while in high vacuum (10^{-6} mbar), under identical experimental conditions, i.e. same thickness, temperature and annealing time, no dewetting takes place. When sandwiched between two thin metal electrodes a characteristic pattern is developed in ambient air above T_g , whereas no changes are observed in high vacuum or in a pure nitrogen atmosphere. These two seemingly unrelated phenomena are suggested to have a common physical origin: due to the presence of remanent oxygen in the immediate vicinity of the polymer films, chain scissions are induced, which result in a pronounced decrease of the average molecular weight. This causes an enhancement of the molecular mobility and a reduction of the corresponding glass transition temperature T_g , as proven by Broadband Dielectric Spectroscopy, AC-calorimetry and capacitive dilatometry. No shifts of the glass transition in thin PS films down to a thickness of 20 nm are detected when the samples are annealed in high vacuum and measured in a pure nitrogen atmosphere.

A. Serghei et al., Phys. Rev. E 71, 061801 (2005).

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Spin-Echo Neutron Reflectivity on Diblock-Copolymer Films — ●MAX NÜLLE¹, ADRIAN RÜHM², JANOS MAJOR¹, ULRICH WILDGRUBER², and HELMUT DOSCH¹ — ¹Max-Planck-Institut für Metallforschung, Heisenbergstr. 3, 70569 Stuttgart — ²Max-Planck-Institut für Metallforschung, ZWE Neue Forschungsneutronenquelle Garching, Lichtenbergstr. 1, 85747 Garching bei München

SERGIS (Spin-Echo Resolved Grazing Incidence neutron Scattering) is a recently developed novel neutron scattering technique which will be routinely employed at the new X-ray/neutron reflectometer N-REX+ at FRM-II. In contrast to conventional scattering methods, SERGIS measures the lateral structure and morphology of surfaces and thin film systems in real space. The spatial resolution is achieved by measuring the total polarization of the scattered beam, without the usual need to collimate the beam in the direction of interest. Therefore SERGIS combines a high neutron flux with the ability to characterize structures from the nanometer scale up into the micron range, and can thus yield novel information about both equilibrium and time-dependent phenomena on these length scales. One typical example is morphologies produced by dewetting phenomena. First results of experiments on diblock-copolymer films will be presented.

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Bottom-Up Lithography: Growing Layout-Defined 3-dimensional Micro- and Nano-Structures by Molecular Self-Assembly — ●MATTHIAS BARCZEWSKI^{1,2}, ALFRED BLASZCZYK¹, MARCEL MAYOR^{1,3}, THOMAS SCHIMMEL^{1,2}, and STEFAN WALHEIM¹ — ¹Institute for Nanotechnology, Forschungszentrum Karlsruhe, 76021 Karlsruhe (Germany) — ²Institute of Applied Physics, University of Karlsruhe, 76131 Karlsruhe (Germany) — ³Chemistry Department, University of Basel, 4056 Basel (Switzerland)

We present a novel soft-lithographic approach for the formation of metal-organic micro- and nanostructures on surfaces. The structures are grown from bottom up, instead of removing material from a resist layer [1]. This can be achieved by making use of an anisotropic molecular self-assembly process which leads to the formation of a metal-organic film which we call Substrate-Consuming Metal-Organic Layer (SCMOL). This growth can be laterally controlled by the pre-deposition of a mono-

molecular two dimensional pattern, by Micro-Contact Printing. This patterned self-assembled monolayer (SAM) acts as a lateral stencil mask for the growth process of the SCMOL film. This process yields structures with perpendicular walls and a lateral resolution of about 20 nm. The height of the structures reaches up to 600 nm - hundred times the height of the constituent molecules.

[1] S. Walheim, M. Barczewski, A. Blaszczyk, M. Mayor, Th. Schimmel Patent application: DE 102005025693.7 (2005)

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Mixed monolayers of phospholipids and amphiphilic block copolymers at the air/water interface — ●S. RALEVA¹, H. HUSSAIN², J. KRESSLER², V. SCHÖN³, P. HUBER³, and B. STÜHN¹ — ¹TU Darmstadt, D-64289 Darmstadt — ²MLU Halle-Wittenberg, D-06099 Halle — ³University of Saarland, D-66041 Saarbrücken

We have investigated the behaviour of mixed monolayers of phospholipids and amphiphilic block copolymers at the air/water interface by measuring the surface pressure/area isotherms in conjunction with x-ray reflectivity measurements. The samples are the synthetic phospholipid diphtanoylphosphatidilcholine (DPhPC) and amphiphilic di- and tri-block copolymers of poly(ethylene oxide) and poly(perfluorohexylethyl methacrylate). From the isotherms we obtain information about the monolayer conformation as a function of the degree of compression. From the x-ray reflectivity measurements we obtain information about the surface roughness, film thickness and electron density variation along the surface normal. We discuss the results as a function of the film composition and the surface pressure. DPhPC isotherms show that the phospholipid exists in the liquid-expanded phase at all surface pressures. The results of monolayer thickness at the air/water interface are in agreement with the results for monolayer of DPhPC on solid substrate. Analysis of the surface pressure/area isotherms shows that the addition of polymer results in homogeneously mixed as well as of non mixed films, depending on the concentration of the added polymer, its composition and surface pressure. X-ray reflectivity measurements results show clear change in the thickness of the film after addition of the polymer.

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Polarized Fourier Transform Infrared Spectroscopy on Thin Chiral Liquid Crystal Elastomer Films — ●MICHAEL TAMMER¹, PATRICK KÖLSCH¹, BIN CHEN², HEINO FINKELMANN², and FRIEDRICH KREMER¹ — ¹Universität Leipzig, Institut für Experimentelle Physik I, Linnéstr. 5, 04103 Leipzig — ²Albert-Ludwigs-Universität Freiburg, Institut für Makromolekulare Chemie, Stefan Meier Str. 31, 79104 Freiburg

Liquid crystalline elastomers (LCE) are consisting of crosslinked polymers with mesogenic units connected to the polymer network. Embedding an anisotropic liquid crystals in an elastic polymer network results in a variety of remarkable features. Their macroscopic form changes strongly with temperature, they are birefringent due to the alignment of the mesogens or they change volume in electric fields, just to name a few of the sophisticated features of this relatively new class of material. The potential applications range from soft contact lenses, artificial muscles, multicolor laser devices to electro-mechanical devices. Polarized Fourier Transform Infrared Spectroscopy (FTIR) is applied to investigate the molecular response of thin liquid crystal elastomer (LCE) films with a cholesteric mesogen structure to an external mechanical stress. The analysis of the absorbance bands for molecular vibrations of the main chain, the spacer groups and bands of the mesogens yields the mean orientations and the order parameters of these molecular units. The influence of the applied strain on the orientation and order is determined.

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Structural and mechanical properties of thin PMMA films prepared by pulsed laser deposition — ●ANDREAS MESCHEDÉ, ERIK SÜSKE, THORSTEN SCHARF, and HANS-ULRICH KREBS — Institut für Materialphysik, Universität Göttingen, Friedrich-Hund-Platz 1, 37077 Göttingen

Thin polymer films were grown by pulsed laser deposition (PLD) at 248 nm in ultra high vacuum (UHV). In the case of poly(methyl methacrylate) (PMMA), the observed films consist of two components which differ in chemical and mechanical properties as molecular mass or amount of crosslinking. These properties can be controlled by deposition parameters like substrate temperature and laser fluence or by using absorption optimized target material. In this contribution the deposition mechanism with respect to the film characteristics, as for example microstructure and mechanical properties, which have been ex-