SYSO 7: Self-Organizing Surfaces and Interfaces VI

Time: Thursday 15:45–17:00 Location: GÖR 226

SYSO 7.1 Thu 15:45 GÖR 226

Modulation of the free surface of smectic liquid crystals by focal conic domains — •Christian Bahr, Wei Guo, and Stephan Herminghaus — MPI for Dynamics and Self-Organization, Bunsenstr. 10, D-37073 Göttingen

If μ-thick films of smectic liquid crystals (LCs) on a solid substrate are subjected to antagonistic molecular anchoring conditions at the film/air and film/substrate interfaces, focal conic domains (FCDs) are generated in which the smectic layers are wrapped around two singular lines (a circle on the substrate surface and a straight line running from the circle center to the air interface).

FCDs often self-organize in regular two-dimensional arrays. They provide the LC film with a superstructure made up by a regular arrangement of defect lines and curved layers, and result in a deformation or modulation of the film/air interface: The curved arrangement of the smectic layers leads to a depression in the film/air interface above each FCD. The depth of these depressions amounts usually to a value between 50 nm and 2 μm and can be measured by AFM [1,2].

We report studies of several different LC/substrate systems and show, how the size and arrangement of FCDs—and thus the shape of the LC/air interface—can be controlled via the anchoring conditions on the substrate and the type of the smectic LC phase.

[1] V. Designolle, S. Herminghaus, T. Pfohl, and Ch. Bahr, Langmuir **22**, 363 (2006).

[2] W. Guo, S. Herminghaus, and Ch. Bahr, Langmuir **24**, 8174 (2008).

SYSO 7.2 Thu 16:00 GÖR 226

Depinning of three-dimensional drops from wettability defects — •Philippe Beltrame[1], Peter Hänggi[1], and Uwe Thiele[2] — [1]Institut für Physik, Universität Augsburg, D-86135 Augsburg, Germany — [2]Department of Mathematical Sciences, Loughborough University, Loughborough, Leicestershire, LE11 3TU, UK

Substrate defects crucially influence the onset of sliding drop motion under lateral driving. A finite force is necessary to overcome the pinning influence even of microscale heterogeneities [1]. The depinning dynamics of three-dimensional drops is studied for hydrophilic and hydrophobic wettability defects using a long-wave evolution equation for the film thickness profile. It is found that the nature of the depinning transition explains the experimentally observed stick-slip motion [2].

[1] Thiele and Knobloch, New J. of Phys. 8 (2006) 313

[2] Beltrame, Hänggi and Thiele, submitted to EPL, (2008), arXiv:0811.2918v1

SYSO 7.3 Thu 16:15 GÖR 226

The dynamics of reaction fronts under different level of gravitational acceleration — •Kerstin Eckert[1], Armin Heinze[1], Laurence Rongy[2], Anne De Wit[2], and Stefan Odenbach[1] — [1]Institute for Fluid Dynamics, Chair of Magnetofluiddynamics, Technische Universität Dresden, D-01062 Dresden — [2]Nonlinear Physical Chemistry Unit, CP 231, Faculté des Sciences, Université Libre de Bruxelles, 1050 Bruxelles, Belgium

When two separate solutions of chemicals A and B, reacting according to the simple kinetic scheme A+B gives C, are brought into contact, the reaction takes place in a localized region, the reaction front. The propagation of such fronts was studied intensively in the past (e.g. Gálfi and Rácz, Phys. Rev. E 38, 3151, 1988) due to their relevance for biological or other physical systems, too. It was indicated recently (Shi & Eckert, Chem. Eng. Sci. 61, 5523, 2006 and Rongy et al. Phys. Rev. Lett. 101, 084503, 2008) that the propagation of these fronts is affected by gravity which leads to a faster motion as predicted by Gálfi and Rácz. We present an experimental study of an immiscible solvent combination placed in horizontal Hele-Shaw cell. A, B and C refer here to acid, base and salt, respectively. We analyse the dynamics of the resulting neutralization front by means of shadowgraph visualization and differential interferometry. The detailed comparison of ground-based and microgravity experiments strongly supports the idea that the reaction front propagation is caused by the interaction between reaction and diffusion with a pair of buoyancy-driven roll cells.

SYSO 7.4 Thu 16:30 GÖR 226

STM bias dependent imaging of molecular double layer — •Christian Seifert[1], Nikolai Severin[1], Daria Skuridina[1], Xi Dou[2], Klaus Müllen[2] und Jürgen P. Rabe[1] — [1]Department of Physics, Humboldt University Berlin, 12489 Berlin — [2]Max-Planck-Institute for Polymer Research, 55128 Mainz

While Aviram and Ratner had proposed a molecular recifyer based on tunneling through donor and acceptor moieties linked by a spacer, it has been argued later that rectification may be also achieved with a single physisorbed donor or acceptor molecule located asymmetrically between two electrodes. The latter was attributed to the dependence of the potential at the position of the molecular orbitals in the tunneling gap on their relative position within the gap. However, it has been also claimed that the potential of a molecular adsorbate is not dependent on the tip- sample distance but rather equal to the substrate potential. Here we report in-situ scanning tunneling microscopy bias dependent imaging of bilayers of conjugated molecules self-assembled at the interface between an organic solution and the basal plane of graphite. The imaging revealed a dependence of the layers visibility on the applied bias as predicted by the model, which confirms that the electron potential drops gradually across the molecular adsorbate. The results indicate that resonance enhanced tunneling through physisorbed molecules between two biased metallic electrodes depends sensitively on the gap width and the relative position of the electronic orbitals within the gap, thereby providing a means to precisely control current-voltage characteristics through the geometry of the gap.

SYSO 7.5 Thu 16:45 GÖR 226

Structure Formation Kinetics in Evaporating Droplets of Diblock-Copolymer Solutions — •Silke Rathgeber[1,2], Diogo Bastos de Toledo[1], Andreas Timmann[3], and Stephan Roth[3] — [1]Max Planck-Institute for Polymer Research, 55128 Mainz, Germany. — [2]Johannes Gutenberg-University, 55099 Mainz, Germany. — [3]HASYLAB at DESY, 22603 Hamburg, Germany.

We followed the structure formation kinetics in droplets of diblock-copolymer solutions during the evaporation process using grazing incidence small-angle x-ray scattering. Aim of our investigation was to get insight which impact the confining interfaces, film-air and film-substrate, have on the structure formation in the droplets during the later stages of the evaporation process. As model system we have chosen poly(styrene)-b-poly(isoprene) (PS-PI) diblock-copolymers solved in anisole, a low-vapor-pressure solvent with sufficient slow evaporation rate. We investigated symmetric as well as asymmetric PS-PI diblock copolymers which form lamellar and hexagonal bulk phases. The particular setup of our experiment allowed us to follow the structural changes occuring at the film-air interface as well as close to the substrate-film interface simultanously. Ordering starts at the substrate. Skin layer formation at the film-air interface is not observed. The talk will discuss the drying scenarios in detail. This includes the appearence of interface mediated structures.