

CPP 1: Focus: Amphiphilic Systems I

Time: Monday 10:45–12:30

Location: ZEU 222

Invited Talk

CPP 1.1 Mon 10:45 ZEU 222

How to make mesoscopic single-crystals — ●STEPHAN FÖRSTER¹, STEFFEN FISCHER¹, KATHRIN ZIELSKE¹, PETER LINDNER², ANDREAS TIMMANN³, and STEPHAN ROTH³ — ¹Institut für Physikalische Chemie, Universität Hamburg, Grindelallee 117, D-20146 Hamburg, Germany — ²Institut-Laue-Langevin, 6 rue Jules Horowitz, F- 38042 Grenoble Cedex 9, France — ³DESY (HASYLAB), Notkestrasse 85, 22603 Hamburg, Germany

Amphiphilic molecules can spontaneously assemble into micelles that can further assemble into cubic superlattices. The local order of these lattices is remarkably high on length scales of up to several hundred nanometers. However, on macroscopic scales the resulting materials contain many defects and have a multi-domain structure with random orientations so that samples are macroscopically isotropic.

For many applications it would be highly desirable to have well-defined macroscopic single crystals. This can be achieved by the application of external fields such as shear. Using in-situ SAXS- and SANS-experiments we have investigated how random multi-domain structures can be arranged into single crystals. Single crystals are prepared with unit cells in the range of 10 to 100 nm showing more than 100 Bragg-peaks. We observe that the orientation pathways show many similarities to the plastic flow behaviour of metals. These pathways can also be used to prepare magnetic and semiconductor nanoparticle superlattices with very high quality and tunable unit cell dimensions.

CPP 1.2 Mon 11:15 ZEU 222

Interfaces in bicontinuous surfactant phases — ●MAXIM BELUSHKIN and GERHARD GOMPPER — Theoretical Soft-Matter and Biophysics, IFF, Forschungszentrum Juelich, Juelich, Germany

Surfactant molecules added to an oil-water system self-assemble into a large variety of structures on the mesoscopic scale. In particular, bicontinuous and lamellar structures are observed. In bicontinuous phases, the surfactant monolayer separates continuous channels of oil and water. In regions of the phase diagram close to the lamellar phase, bicontinuous phases with long-range order emerge. In these cubic phases the surfactant monolayer forms triply periodic minimal surfaces. In amphiphilic systems many kinds of interfaces occur: between two ordered phases, between ordered and disordered phases, and between two grains of the same ordered phase.

Using a Ginzburg-Landau theory of ternary amphiphilic systems we study two classes of interfaces in bicontinuous surfactant phases - twist grain boundaries in cubic phases and microemulsions in contact with hydrophilic/hydrophobic surfaces. Twist grain boundaries are found to be minimal surfaces. The interfacial tension is very small and exhibits a non-monotonous dependence on the twist angle. For microemulsions near a hydrophilic wall, the nucleation of a lamellar phase at the surface is observed for regions in the phase diagram close to the microemulsion-lamellar phase transition.

CPP 1.3 Mon 11:30 ZEU 222

Microemulsions near planar surfaces — ●MICHAEL KERSCHER¹, HENRICH FRIELINGHAUS², and DIETER RICHTER¹ — ¹Institute for Solid State Research, Forschungszentrum Jülich GmbH D-52425 Jülich — ²Jülich Centre of Neutron Science, Forschungszentrum Jülich GmbH, Lichtenbergstr. 1, D-85747 Garching

Microemulsions have a great variety of uses in industrial application. Most of these applications like oil productions and cleaning imply the presence of huge surfaces. The influence of such surfaces on the domain structure of microemulsions is studied using the example of a planar, hydrophilic wall. In our studies, it shows that the ordering near the wall is locally elevated, while the bulk state is reached far from the surface. Using neutron reflectometry and grazing incidence small angle neutron scattering (GISANS) the alternating domain sequence and the lateral order in the sample is recorded. The sample is studied in GISANS, where we varied the overall scattering length density in order to vary the penetration depth of the evanescent wave, while the bulk contrast remains dominating. In this way the lateral order is resolved as a function of the depth, and the local ordering near the surface can be resolved. These measurements are the first of their kind. The reflectometer measurements aim mainly at the structure in the normal direction. Thus, the thickness of an ordered phase near the surface can be measured. The collected information will be used to improve

the microemulsion behavior near surfaces in the static state and under flow. By using amphiphilic polymers as additives the response of the system to the surface and the flow will be tailored.

CPP 1.4 Mon 11:45 ZEU 222

Adsorption and Near-Interface Structure of Tri-block Copolymer Micelles — ●NICOLE VOSS¹, MARCO WALZ¹, STEFAN GERTH¹, PHILIPP GUTFREUND², MAX WOLFF², HARTMUT ZABEL², and ANDREAS MAGERL¹ — ¹Chair for Crystallography and Structural Physics, University of Erlangen-Nürnberg, Staudtstr. 3, 91058 Erlangen, Germany — ²Chair for Solid State Physics/EP IV, Ruhr-University Bochum, Universitätsstr. 150, 44780 Bochum, Germany

Micellar solutions of block copolymers have rich phase diagrams and they are an excellent model system for the study of crystallization in soft matter. Further, the surface active properties of these systems lead to a distinct sensitivity of micellar structures on the wettability of a solid boundary.

In our studies we investigated the tri-block copolymer EO(20)-PO(70)-EO(20) solved in water using in-situ rheometry, Grazing Incidence Small Angle Neutron Scattering (GISANS) and neutron reflectometry to extract the structural arrangements close to a solid interface in concentrated and dilute solutions. We report on the dependence of structural properties and interfacial adsorption of micelles on surface energy and temperature. After the cessation of applied shear we find a relaxation of the crystalline structure which is determined by the type of micellar structure as well as by the chemical potential of the adjacent surface.

CPP 1.5 Mon 12:00 ZEU 222

Switching of Electrical Conductivity in Microemulsions — ●THOMAS WOLFF and MARKUS BUFE — Technische Universität Dresden, Physikalische Chemie, 01062 Dresden

Microemulsions exhibit three types of macroscopically monophasic solutions structures: water droplets in oil (w/o), oil droplets in water (o/w), and bicontinuous (sponge-like). In the latter two structures water forms a continuous phase. As a consequence these two structures show electrical conductivity in contrast to w/o. Transitions between the solutions states can be achieved by varying composition or temperature. The onset of electrical conductivity in conductivity versus temperature curves can be taken as the percolation temperature indicating the transition o/w - bicontinuous.

We have reported systems in which percolation temperatures are influenced by the presence of certain solubilizers. Photochemically reactive solubilizers allow isothermal switching of conductivity (without turning a mechanical contact), provided photoelect and photoproduct induce different percolation temperatures. The solubilizers thus act as large response triggers for varying the solution structure. However, the systems described so far [1 and references therein] allow switching in one way only, i.e. from conductive to non-conductive or vice versa.

Here we present AOT systems, in which thermally reversible photoreactions of solubilizers are used, so that the conductivity can be switched on under light (e.g. at daytime) and disappears in the dark (e.g. at night).

[1] M. Bufe, T. Wolff, Phys. Chem. Chem. Phys. 8 (2006) 4222-4227

CPP 1.6 Mon 12:15 ZEU 222

Thermodiffusion of non-ionic sugar surfactants — ●BASTIAN ARLT¹, SASCHA DATTA², THOMAS SOTTMANN², and SIMONE WIEGAND¹ — ¹IFF - Weiche Materie, Forschungszentrum Jülich, Germany — ²Institut für Physikalische Chemie, Universität zu Köln, Germany

Thermodiffusion describes the formation of a concentration gradient due to a temperature gradient in a solution. The strength of this effect is described by the Soret coefficient (S_T): a positive Soret coefficient of a component implies that this component moves to the cold side.

In this work we investigate the thermal diffusion behavior of non-ionic sugar surfactants in water using the IR-TDFRS [1] and the classical TDFRS [2]. First studies on C_8G_1 (n-Octyl β -D-glucopyranoside) indicate a pronounced change in S_T at the critical micelle concentration (cmc) which coincides with an observation by Santos *et al.* [3], who observed a significant change in the strength of the thermal lens signal at the cmc. Furthermore, we observed a temperature dependent

sign change in S_T for higher concentrated solutions. With the classical TDFRS setup which uses a dye, we observe that S_T is independent of the presence of dye, if the concentration is below the cmc, while S_T differs for higher concentrations. We can conclude that the dye

molecules are incorporated as a cosurfactant into the micelles.

[1] H. Ning *et al.*, J. Phys. Chem. B, **112**, 10927 (2008) [2] H. Ning *et al.*, J. Phys. Chem. B, **110**, 10746 (2006) [3] M. P. Santos *et al.*, Phys. Rev. E **77**, 011403 (2008)