

CPP 3: Focus: Amphiphilic systems III

Time: Monday 18:00–19:15

Location: ZEU 222

Invited Talk CPP 3.1 Mon 18:00 ZEU 222
Formation and exchange kinetics of block copolymer micelles — ●REIDAR LUND — Donostia International Physics Center/ University of the Basque Country, Paseo Manuel de Lardizabal 4, 20018 San Sebastián

In this presentation, we will review results of both the kinetics associated with unimer exchange in the equilibrium state and the non-equilibrium formation kinetics of block copolymer micelles. For the former, we have shown in a series of experiment using TR-SANS and a novel deuteration scheme, that the unimer exchange of block copolymer micelles is characterized by a very slow logarithmic decay [1]. This opposes the theoretically predicted exponential kinetics proposed by Halperin and Alexander a long time ago. For the latter micellization kinetics, we will show some very recent results [2] using time resolved synchrotron x-ray scattering in combination with stopped-flow where the birth of block copolymer micelles can be directly seen on the millisecond time range. We will further demonstrate that the self-assembly process can be quantitatively described as a special nucleation & growth process where the dominating elemental growth mechanism is stepwise unimeric (single chain) addition without invoking any more complicated higher order mechanism such as fusion/fission.

References [1]R. Lund; L. Willner; J. Stellbrink and D. Richter Phys. Rev. Lett. 96 068302 (2006) [2]R. Lund; L. Willner; M. Monkenbusch; P. Panine; T. Narayanan; J. Colmenero and D. Richter submitted

CPP 3.2 Mon 18:30 ZEU 222

Responsive Polymer Cushions for Lipid Bilayer Manipulation — ●MARTIN KAUFMANN¹, DIRK KUCKLING², CARSTEN WERNER¹, and TILO POMPE¹ — ¹Leibniz Institute for Polymer Research, Dresden, Germany — ²University of Paderborn, Department of Chemistry, Germany

Supported lipid bilayer membranes (sLBM) are used to study the function of membranes of living cells. We introduce a pH- and thermoresponsive polymer cushion platform which allows for a switching of the interaction of the sLBM and incorporated transmembrane biomolecules with the solid support. Copolymers composed of N-isopropylacrylamide (NiPAAm) and varying amounts of acrylamide derivatives bearing carboxylic groups at different spacer length were immobilized as thin films and characterized by quartz crystal microbalance. Cushion thickness could be switched between 15–150 nm in response to changes in pH and temperature with lower critical solution temperatures in biological relevant ranges of 15–45 °C. sLBM were successfully formed from a lipid mixture composed of 90% DOPC and 10% DOTAP. First sLBM mobility measurements using fluorescence recovery after photobleaching revealed diffusion coefficients on swollen copolymer films ($8.0 m^2 s^{-1}$) distinctly higher than on SiO₂ sLBM ($6.0 m^2 s^{-1}$). This finding proposes a reduced friction between lipids and the copolymer cushion in comparison to SiO₂. The copolymer cushion responsiveness will be used to further adjust lipid-support interaction and to vary the characteristics of incorporated transmembrane proteins.

CPP 3.3 Mon 18:45 ZEU 222

Temperature dependent swelling and switching kinetics of gold coated end-capped PNIPAM thin films — ●WEINAN WANG¹, JAN PERLICH¹, GUNAR KAUNE¹, ACHILLE M. BIVIGOU KOUMBA², ANDRE LASCHEWSKY², CHRISTINE M. PAPADAKIS¹, ROBERT CUBITT³, and PETER MÜLLER-BUSCHBAUM¹ — ¹TU München, Physik - Department E13, James-Franck-Str. 1, D-85747 Garching, Germany — ²Uni. Potsdam, Inst. Chemie, Karl-Liebknecht-Str. 24-25, D-14476 Potsdam-Golm, Germany — ³ILL, b.p. 156, 38042 Grenoble, France

Poly(N-isopropylacrylamide) (PNIPAM) is one of the prominent stimuli-sensitive hydrogels for the construction of nanoscale sensors which are sensitive to water and to water vapour (humidity). We choose PNIPAM end-capped with n-butyltrithiocarbonate (nbc-PNIPAM), a very short hydrophobic end group, to introduce an internal ordering and increase the mechanical stability in the films without sacrificing the swelling ability seriously. Two different gold layers with 0.4 nm and 5 nm thickness are coated on the nbc-PNIPAM surface by sputtering. The surface and internal structure of the dry films are characterized with AFM and GISAXS. The lower critical solution temperature (LCST) of the films in the water vapour is determined with white light interferometry. The temperature dependent swelling and switching kinetics in water vapour of such sensor films is probed by in-situ neutron reflectometry. The real time water diffusion and thickness changes for the two different gold layer thicknesses are compared and discussed in the framework of sensor applications. [1] W. Wang et al., *Macromolecules* 41, 3209-3218 (2008)

CPP 3.4 Mon 19:00 ZEU 222

Self-Assembly of Symmetric Single-Chain Bolaamphiphiles: The Formation of Temperature, Ionic Strength and pH-responsive Hydrogels — ●ANNETTE MEISTER¹, SIMON DRESCHER², MARTIN BASTROP¹, GÖRAN KARLSSON³, VASIL GARAMUS⁴, BODO DOBNER², and ALFRED BLUME¹ — ¹Martin-Luther-University Halle-Wittenberg, Institute of Chemistry, Halle, Germany — ²Martin-Luther-University Halle-Wittenberg, Institute of Pharmacy, Halle, Germany — ³Uppsala University, Department of Physical Chemistry, Uppsala, Sweden — ⁴GKSS Research Centre, Geesthacht, Germany

The bolaamphiphile dotriacontane-1,w-diyl-bis[2-(dimethylammonio)-ethylphosphate] was found to be an excellent hydrogelator by forming a dense network of nanofibers [1]. The temperature, ionic strength and pH dependent aggregation behaviour of this bolaamphiphile in water was investigated using DSC, rheological measurements, SANS and cryo-TEM. SANS and cryo-TEM indicate the formation of a dense network of nanofibers below the first and second DSC transition temperature and the presence of micelles above the second and third transition temperature. However, rheological measurements point out that the formation of stable hydrogels is only possible at low pH, where the headgroups are in a zwitterionic state. At higher pH values, where the headgroup is deprotonated and negatively charged, a fluid with Newtonian behaviour is obtained.

[1] Meister, A.; Bastrop, M.; Koschoreck, S.; Garamus, V. M.; Sine-mus, T.; Hempel, G.; Drescher, S.; Dobner, B.; Richtering, W.; Huber, K.; Blume, A. *Langmuir*, 2007, 23, 7715.