CPP 19: Charged Soft Matter

Time: Wednesday 9:30–11:00

CPP 19.1 Wed 9:30 C 243

Structure and Dynamics of Polyelectrolytes in Aggregates with oppositely charged Surfactants — •Ingo Hoffmann[1,2], Bela Farago[2], Norman J. Wagner[3], and Michael Gradzielski[1] — [1]TU Berlin, Berlin, Germany — [2]Institut Laue Langevin, Grenoble, France — [3]University of Delaware, Newark, USA

Systems composed of oppositely charged polyelectrolytes and surfactants show rich self-aggregation behavior that varies over a large size range and have many applications e.g. in cosmetics, detergency and drug delivery. Mixtures of the cationic polyelectrolyte JR 400 with anionic surfactants (SDS, SDBS) in the semi-dilute regime with a slight excess of polymer charges form highly viscous network structures. In this study we investigated the structure and dynamics of the aggregates and its individual components i.e., the polyelectrolyte chain and the surfactant, with the aid of small-angle neutron scattering (SANS) and neutron spin-echo (NSE). Neutron scattering provides the unique ability to match the contrast of a certain component with that of the solvent by changing its isotopic composition and thereby rendering it *invisible*. This is achieved bu using a deuterated surfactant (d-SDS) and an appropriate mixture of H_2O and D_2O as solvent.

In summary, we studied the behaviour of polyelectrolytes in solutions of mixed aggregates of polyelectrolytes and oppositely charged surfactants using neutron scattering to gain an understanding of the role of the individual components in the formation and dynamics of such aggregates. This understanding can be valuable for the design of future formulations.

CPP 19.2 Wed 9:45 C 243

Weak polyelectrolyte adsorption onto oppositely charged interfaces: planar, cylindrical, and spherical geometries. — •Andrey Cherstvy and Roland Winkler — Institute of Complex Systems, ICS-2/IAS-2, Forschungszentrum Jülich, 52425 Jülich, Germany

We suggest a universal description for weak adsorption of flexible polyelectrolytes (PE) onto oppositely charged planar and curved surfaces [Phys. Chem. Chem. Phys., 13 11686 (2011)]. The analysis is based on the WKB quantum mechanical method for the Green function equation. We provide a unified picture for scaling behavior of the critical characteristics and thickness of adsorbed PE layer formed near the interfaces. We find that curved convex interfaces necessitate much higher surface charge densities to trigger the PE adsorption. Different geometries also yield distinct scaling laws for the critical surface charge density $\sigma^\star$. Namely, at low-salt $\sigma^\star$ scales cubical with the inverse Debye screening length for a plane, quadratic for an adsorbing rod, and linearly for a sphere. These novel scaling trends for PE-rod and PE-sphere adsorption are consistent with the complex formation experiments from P. Dubin lab. Above the adsorption threshold, the thickness of the adsorbed PE layer predicted is consistent with other theoretical models. Our analysis can provide a more realistic description of adsorption of charged biopolymers at biologically-relevant conditions.

CPP 19.3 Wed 10:00 C 243

Simulations of charged dendrimer-linear polyelectrolyte complexes with explicit counterions — •Jarosław Sylwester Kłos[1,3] and Jens Uwe Sommer[1,2] — [1]Leibniz-Institut für Polymerforschung Dresden e.V., 01069 Dresden, Germany — [2]Institute for Theoretical Physics, Technische Universität Dresden, 01069 Dresden, Germany — [3]Faculty of Physics, A. Mickiewicz University, Umultowska 85, 61-614 Poznan, Poland

We study complexes comprised of one $G4$ dendrimer with $N_t = 32$ positively charged end groups and an oppositely charged linear polyelectrolyte accompanied by counterions in an athermal solvent using Monte Carlo simulations based on the bond fluctuation model. In our study both the full Coulomb potential and the excluded volume interactions are taken into account with the reduced temperature τ and chain length N_{ch} as the simulation parameters. Our calculations indicate three temperature ranges that determine the behavior of such complexes. At $\tau_{complex}$ complexes are formed first, which are ac-

companied by selective counterion localization within the complex at $\tau_{loc} \leq \tau_{complex}$. Counterion condensation takes place as temperature is decreased below $\tau_{cond} < \tau_{loc}$. We observe that condensation occurs exclusively on the excess charges in the complex and thus no condensation is observed at the compensation point ($N_{ch} = N_t$) no matter τ. For $N_{ch} \neq N_t$ the complex is overally charged. We also find that more rigid chains take a variety of shapes including oblate, spherical and rodlike ones. At low τ a sharp release of tails by long chains is detected by increasing their rigidity.

CPP 19.4 Wed 10:15 C 243

Electro-kinetics of Charged Sphere Suspensions Explored by Integral Low Angle Super-Heterodyne Laser Doppler Velocimetry — •Bastian Sieber, Holger Schweinfurth, Tetyana Köller, and Thomas Palberg — Johannes Gutenberg Universität, D-55128 Mainz, Germany

We investigated the flow behaviour of colloidal charged-sphere suspensions using a newly designed integral low angle super-heterodyne laser Doppler velocimetry which combines the advantages of several previous approaches. The obtained power spectra correspond to diffusion broadened velocity distributions across the complete sample cross section. The excellent performance of the instrument is highlighted in detail at the example of electro-kinetic flow of suspensions in a closed cell of rectangular cross section. We demonstrate that our instrument allows for convenient and simultaneous quantitative determination of the electro-phoretic mobility, the electro-osmotic mobility, the particle flow profile, an effective diffusion coefficient, and the spectral power as a function of interaction conditions.

CPP 19.5 Wed 10:30 C 243

Diffusion of nanoparticles at an air/water interface is not invariant under a reversal of the particle charge — •Tobias Gehring and Thomas M. Fischer — The University of Bayreuth, Germany

The diffusion of charged nanoparticles at an aqueous/air interface is not invariant under a charge reversal of the particles. Negatively charged particles slow down with the ionic strength of the aqueous phase, while positively charged particles speed up. The diffusion constant of the particles reflects their immersion into the aqueous/air interface. We argue that the opposing behavior of oppositely charged particles is proof that the immersion depth of the particles scales with the contrast in electric surface potential of the particle to the electric surface potential of the air/water interface, not with the particle*s charge density. We therefore propose to incorporate the potential drop across the air/water interface into theories of electrodipping.

CPP 19.6 Wed 10:45 C 243

Enhanced charge transport in nano-confined ionic liquids — •Ciprian Ghiorghita Iacob, Joshua Sangoro, Wycliffe Kipnusu, Rustem Valiullin, Jörg Kärger, and Friedrich Kremer — Institute of Experimental Physics I, University of Leipzig, Leipzig, Germany

Charge transport in ionic liquids contained in unidirectional nanoporous membranes (pore diameters: 7.5-10.4 nm) is investigated by combining Broadband Dielectric Spectroscopy (BDS) and Pulsed Field Gradient (PFG)-NMR [1-3]. This enables one to determine the diffusion coefficient and the diffusion rate over more than 13 decades and to trace its temperature dependence [4, 5]. Under conditions of nanometric confinement, a change from a Vogel-Fulcher-Tammann into an Arrhenius-like thermal activation is observed, resulting in an enhancement of diffusivities by more than two orders of magnitude. The effect becomes more pronounced with decreasing pore diameter. It is attributed to changes in molecular packing and hence in density leading to higher mobility and electrical conductivity.

References 1. Iacob, C.et al., Phys. Chem. Chem. Phys.,12(41): p. 13798-13803,2010. 2. Iacob, C.et al., Soft Matter, 2011. 3. Kremer, F., Schönhals, A.,Berlin: Springer,2003. 4. Sangoro, J.R. and Kremer, F.,Accounts of Chemical Research, 2011. 5. Sangoro, J.R., et al. Soft Matter, 7(5): p. 1678-1681, 2011.