CPP 9: POSTER: Colloids and Nanoparticles

Time: Monday 16:00–18:00 Location: Poster B

CPP 9.1 Mon 16:00 Poster B

Zinc oxide nanoparticles inside microgel — •Mukesh Agrawal[1], Andrij Pich[2], Nick Zafeiropoulos[1], and Manfred Stamm[1] — [1]Leibniz-Institut für Polymerforschung Dresden e.V., Hohe Straße 6, 01069 Dresden, Germany — [2]Institut für Makromolekulare Chemie und Textilchemie, Technische Universität Dresden, Mommsenstr 4, 01062 Dresden, Germany

We investigate on the synthesis of temperature and pH-sensitive hybrid microgels containing ZnO nanoparticles. The synthesis of ZnO nanoparticles was carried out in the presence of poly(N-vinylcaprolactum-co-acetoacetoxyethylmethacrylate-co-N-[3-dimethylamino)propyl] methacryl amide)(VCL/AAEM/PDMAPMAm) and it was observed that these microgels act as the container for deposition of ZnO nanoparticles, under the specific reaction conditions, leading to the formation of hybrid microgels. A close relationship between changes in properties of microgels and the loaded ZnO content was reported. Microscopic studies confirmed the inclusion of nanoparticles into microgels. It has been found that prepared microgels have tendency to form composite films on solid substrates after water evaporation, with homogenous distribution of ZnO nanoparticles in polymer matrix.

CPP 9.2 Mon 16:00 Poster B

Fluctuation-induced interaction between anisotropic colloids at fluid interface — •Ehsan Noruzifar and Martin Oettel — Institut fuer Physik, WA 331, Johannes-Gutenberg-Universitaet Mainz, 55099 Mainz, Germany

The effective interaction between anisotropic particles trapped at fluid interface necessarily contains a long-ranged part caused by capillary wave fluctuations [1]. Due to the restrictions the colloids impose on the capillary waves, the interaction is of Casimir type which can be calculated by integrating on all possible interface configuration weighted by a simple capillary wave Hamiltonian. For the specific case of ellipsoids, we consider the resulting anisotropic interaction with regard to ordering phenomena on the interface [2].

[1] H. Lehle, M. Oettel, and S. Dietrich, Eur. Phys. Lett. 75 (2006) 174

[2]J. C. Loudet, A. M. Alsayed, J. Zhang, and A. G. Yodh, Phys. Rev. Lett. 94 (2005) 018301

CPP 9.3 Mon 16:00 Poster B

Front instabilities in evaporating films of nanoparticle suspensions - simulation results — •Ioan Vancea[1], Christopher Martin[2], Emmanuelle Vaujour[2], Philip Moriarty[2], and Uwe Thiele[1] — [1]Max-Planck-Institut fur Physik komplexer Systeme, Noethnitzer Str. 38, D-01187 Dresden, Germany — [2]School of Physics & Astronomy, The University of Nottingham, University Park, Nottingham, NG7 2RD, United Kingdom

Various experimental settings involving drying suspensions of nanoparticles have been used to produce patterned nanoparticle layers [1,2]. Beside polygonal networks and spinodal structures one finds branched structures.

Using a variant of a Monte Carlo model introduced by Rabani et al. [1], we study front instabilities of initially straight or circular fronts.

We discuss in detail the influences that lead to the fingered structures. We show that even with a simple model including evaporation as the only dynamic process it is possible to determine many properties of the finger patterns.

Especially, we present results for a straight dewetting front that becomes transversally unstable depending on driving force (chemical potential), nanoparticle concentration and mobility (inverse of an effective viscosity). The fingering becomes stronger with increasing chemical potential and decreasing mobility. Concepts of quantification of the fingering are also discussed.

[1] E. Rabani et al., Nature **426**, 271-274 (2003).

[2] C. P. Martin et al., Nano Lett. **4**, 2389-2392 (2004).

CPP 9.4 Mon 16:00 Poster B

Influence of a Limited q-range on the Results obtained from Scattering Experiments — •Gerald Johannes Schneider and Dietmar Göritz — Institut für Physik, Universität Regensburg, 93040 Regensburg

Scattering methods are widely used for investigating the structure of colloidsized objects. However, considering hierarchical structures, like e. g. colloidal silica, objects at characteristic length scales ranging from a few Angstrom up to millimeters are involved. Thus, even by combining different scattering techniques, in particular X-ray, neutron, and light scattering methods, a complete information on the structure is not available.

In our contribution we investigate the influence of the limitation of the q-range available. For this purpose, scattering diagrams were calculated to show the influence of the range of the momentum transfer to the radius of the gyration of the object extracted from the scattering curves. We show, if the the minimum value for the momentum transfer is not small enough, the error for the radius of gyration will be very large.

CPP 9.5 Mon 16:00 Poster B

Microstructure studies of microemulsions for decontamination — •Stefan Wellert[1], Henrik Imhof[1], Andre Steppin[1], Thomas Hellweg[1], Michael Dolle[2], Hans-Juergen Altmann[2], and Andre Richardt[2] — [1]TU Berlin, Stranski-Labor, Strasse des 17. Juni 124, D-10623 Berlin — [2]Armed Forces Scientific Institute, (NBC-Protection) P.O.Box 1142, D-29623 Munster

A growing field of interest is the use of microemulsions as new and more efficient decontamination media for a variety of toxic compounds, for example organophosphorous agents. Because of the large internal surface water-in-oil microemulsions and bicontinuous structures are of interest for the mentioned application. In order to form environmentally compatible and effective decontamination media we studied the phase behavior of quaternary systems consisting of water, surfactant (IHF, APG), cosurfactant (2-propanol, pentanol) and different oils. The identified stable one-phase regions were investigated with scattering methods. To gain insight in the phase structures SAXS, DLS and SANS measurements were performed as a function of surfactant, cosurfactant and water content. A large internal surface is essential for a fast and efficient decontamination process. This large contact area between the contaminants solubilized in the oil phase and the active agents in the water phase leads to a strong influence of the structure factor S(q). Due to this SANS contrast variation experiments were performed to extract the influence of the structure factor on the form factor signal. The results of these measurements are related to the measured efficiencies of the decontamination process.

CPP 9.6 Mon 16:00 Poster B

Decontamination with sugar surfactant based microemulsions — •Stefan Wellert[1], Henrik Imhof[1], Andre Steppin[1], Thomas Hellweg[1], Michael Dolle[2], Hans-Jürgen Altmann[2], and Andre Richardt[2] — [1]TU Berlin, Stranski-Lab., Strasse des 17. Juni 124, D-10623 Berlin — [2]Armed Forces Scientific Institute (NBC-Protection), P.O.Box 1142, D-29623 Munster

Environmental compatibility is one of the most important features of modern decontamination media for a large variety of toxic compounds as warfare agents or pesticides. Different selection factors like capacity, effectiveness, universality and economy determine the formulation and development of such systems. We showed by a study of the phase behavior the possibility to replace an existing macroscopic system by microemulsions containing the same main components. Environmental non harmful and non corrosive organic solvents and the use of APG surfactants promise a simple and safe application. To meet these requirements we used technical sugar surfactants and beside PCE also less harmful solvents like xylene and Biodiesel fuel. We present results from studies of the phase behavior of quaternary systems and the influence of an additional active component is discussed. For the decontamination oxidizing agents and enzymes are promising active components. The decontamination efficiency of both systems is first estimated on the basis of the ability to wet typical non-chemical resistant coated steel sheets. Afterwards, promising samples are tested using real surfaces covered with nerve agent.

CPP 9.7 Mon 16:00 Poster B

Silica Particle Distribution in Styrol Butadiene Rubber — •Gerald Johannes Schneider[1], Dietmar Göritz[1], Gerd Weidemann[2], Jürgen Goebbels[2], and Heinrich Riesemeier[2] —

[1]Institut für Physik, Universität Regensburg, 93040 Regensburg — [2]Federal Institue for Material Research and Testing (BAM), Berlin

Due to the widespread use, studying the structure of silica is of general interest for fundamental research and for applications. For example, it is well known that rubber filled with silica can be used to improve the mechanical properties of the composite material. The goal of many different material models is to describe this so called reinforcement effect. The models depend on reliable information about the structure of the filler. However, the length scales involved range from nanometers up to millimeters and thus a complete study does not exist. Using synchrotron X-ray tomography experiments we are able to study the structure of silica in rubber with a resolution of 600 nm. Thus, one can investigate the micro dispersion of silica in rubber.

CPP 9.8 Mon 16:00 Poster B

In-situ investigation of the interfaces of a block copolymer solution under shear stress with μ-focus GISAXS — •Andreas Timmann[1], Stephan Volkher Roth[1], Steffen Fischer[2], and Stephan Förster[2] — [1]HASYLAB at DESY, Notkestr. 85, D-22603 Hamburg, Germany — [2]University of Hamburg, Inst. f. Phys. Chem., Grindelallee 117, D-20145 Hamburg, Germany

Block-copolymers are interesting for their ability to self organize in various structures. In dilute solution they form micelles, cylindrical micelles and vesicles. The length scales of these structures ranges from about 5 nm up to several hundred nanometers. Hence such structures are well suited for investigations using small-angle X-ray scattering (SAXS).

The experiments were performed the beamline BW4 at HASYLAB, Hamburg [1] using the microfocus setup. We present the results of the investigation of an 14.1 wt.% solution of a poly-(isoprene-blockehtylene oxide) in water. The block degrees of polymerization of the Isopren and the polyethylene oxide were 107 and 343, respectively.[2] The shear stress was applied by a stress-controlled Bohlin CVO rheometer in a plate-plate-geometry with a diameter of 20 mm and a gap of 1 mm. We investigated the interface layers of the solution to air and to the metal plates of the geometry, respectively. We found a dependency of the layer thickness of the metal-solution interface on the application of shear.

References: [1] Roth et al., Rev. Sci. Instrum., 2006, 77, 085106
[2] A. Timmann, Doctoral Thesis, University of Hamburg, 2005

CPP 9.9 Mon 16:00 Poster B

Interaction of magnetic colloids in periodic potentials — Larysa Baraban, •Artur Erbe, and Paul Leiderer — Universität Konstanz, FB Physik, Germany

Magnetic colloids are widely used as model systems for a variety of processes in statistical physics. In this work we study the behavior of micron-sized particles exhibiting a permanent magnetic moment. This moment is generated by a magnetic cap, which enables us to observe the direction of the magnetic moment with standard video microscopy. Thus interactions in large particle arrays can be observed. We demonstrate the creation of such arrays in square and triangular symmetry and investigate the particle-particle interactions as well as the interactions with the substrate. The magnetic moments of the particles are characterized using SQUID, MFM, and magnetooptic techniques.

CPP 9.10 Mon 16:00 Poster B

Layer and lane formation in driven magnetic colloidal particles — •Marcin Zientara, Michael Koppl, Artur Erbe, and Paul Leiderer — Universität Konstanz, FB Physik, Germany

The process of lane formation is a nonequlibrium phase transition occuring in two-component systems under the action of external forces. It aims at an increase of transport or motion efficiency if particles are driven by forces acting in opposite directions. The simplest situation to imagine is a mixture of particles, half of which has a positive charge and half has a negative charge. Such particles can be moved in opposite directions, if an external eletric field is applied. If the force exceeds a certain threshold, the motions will separate and ordered lanes will appear. This phenomenon has been studied theoretically in a wide range of systems. We show experimental results of paramagnetic particles confined in a narrow channel driven by gravity. In this system layering of the particles leads to a similar ordering phenomenon. In a mixture of magnetic and non-magnetic particles lane formation is expected, if the particles are driven in opposite directions by application of a gradient in the magnetic field in combination with gravity.

CPP 9.11 Mon 16:00 Poster B

Dependency of colloid overcharge on the salt concentration — •Olaf Lenz[1], Marcia Barbosa[2], and Christian Holm[1] — [1]FIAS, Frankfurt am Main, Germany — [2]Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil

We have performed coarse-grained MD simulations of a highly charged colloid in a solution of 3:1 and additional 1:1 salt. The dependency of the colloid's overcharge on the concentration of the additional 1:1 salt has been studied. Depending on the colloid's characteristics and the concentration of the multivalent ions, a non-monotonic behavior has been found.

We compare these results with the theoretical predictions from a density functional theory by M. Barbosa.

CPP 9.12 Mon 16:00 Poster B

Employing TIRM to measure critical casimir forces in a binary liquid — •Laurent Helden, Christopher Hertlein, and Clemens Bechinger — 2. Physikalisches Institut, Pfaffenwaldring 57, D-70550 Stuttgart

The technique of total internal reflection microscopy (TIRM) is capable to measure interactions of a spherical colloidal particle close to planar wall. Forces as small as 5 fN can be detected, thus TIRM can be employed to directly measure extremely weak interactions like critical casimir forces.

Due to concentration fluctuations a colloidal particle suspended in a binary liquid at the critical composition close to a substrate experiences a critical casimir force upon approaching the critical temperature of decomposition T_c. We have directly measured interaction potentials for a polystyrene particle suspended in a mixture of water and $2,6$ -lutidine approaching T_c. In agreement with theoretical predictions strongly temperature dependent forces were detected. The sign of the forces depends on the wetting properties of probe particle and substrate.

CPP 9.13 Mon 16:00 Poster B

An Investigation of Precipitated Silica using Transmission Electron Microscope Tomography — •Benjamin Georg Greiner, Gerald Johannes Schneider, and Dietmar Göritz — Institut für Physik, Universität Regensburg, 93040 Regensburg

In general the morphology of active fillers is investigated using transmission electron microscopy. However, only projections of the samples are accessible. Thus, one can not differentiate between a disc-like or a spherical structure. In order to obtain such information we investigated precipitated silica using different tilt angles between the sample and the wave vector of the incident electron beam and reconstructed a three dimensional volume of the object. This method, denoted as electron tomography, allows a detailed investigation of the structure of objects at a length scale of a few nanometers. In particular a detailed investigation of the shape is possible.

CPP 9.14 Mon 16:00 Poster B

Capillary interaction between ellipsoidal colloids at a fluid interface — •Hartwig Lehle[1,2] and Martin Oettel[1,3] — [1]Max-Planck-Institut für Metallforschung, Heisenbergstr. 3, 70569 Stuttgart — [2]Institut für Theoretische und Angewandte Physik, Universität Stuttgart, Pfaffenwaldring 57, 70569 Stuttgart — [3]Institut für Physik, WA 331, Johannes-Gutenberg-Universität Mainz, 55099 Mainz

In two recent publications, Loudet *et al.* describe the behavior of μm-sized ellipsoidal colloids trapped at a water-oil interface [1,2]. They find a strong anisotropic attractive force between the colloids which leads the formation of complex chain- or raftlike structures at the interface and which can be qualitatively explained by the capillary interaction due to a quadrupolar meniscus deformation caused by the particle's anisotropy. A thorough theoretical investigation of these phenomena is, however, missing so far.

In a systematic approach we derive a quadratic free energy functional of the interface and the colloids trapped at it. Upon minimizing the free energy we calculate the equilibrium meniscus profiles of both, a single ellipsoid and two ellipsoids in arbitrary orientation with respect to each other. Finally, from the interface profiles we determine the orientation dependent capillary force between the ellipsoidal particles and discuss the results in detail.

[1] J. C. Loudet, A. M. Alsayed, J. Zhang, and A. G. Yodh, Phys. Rev. Lett. **94**, 018301 (2005)

[2] J. C. Loudet, A. G. Yodh, and B. Pouligny, Phys. Rev. Lett. **97**, 018304 (2006)

CPP 9.15 Mon 16:00 Poster B

Soft X-ray Spectromicroscopy at the Swiss Light Source — •George Tzvetkov[1,2], Jörg Raabe[2], Rainer Fink[1], and Christoph Quitmann[2] — [1]Physikalische Chemie II, Friedrich-Alexander Universität Erlangen-Nürnberg, D-91058 Erlangen, Germany — [2]Paul Scherrer Institut, 5232 Villigen, Switzerland

A new X-ray scanning transmission microscope (STXM) located at the Paul Sherrer Institut, Villigen, is now available. The microscope is attached to the PolLux beamline at the Swiss Light Source synchrotron laboratory.The central theme of the STXM is the ability to obtain morphological and chemically-specific information on a full range of materials (inorganic/organic) under real conditions thus providing a unique facility. The operating energy range (from 200 eV to 1 keV) encompasses a significant number of important K- and L-absorption edges, and relatively thick samples can be studied with absorption contrast technique (NEXAFS spectroscopy). The range of potential applications is truly interdisciplinary, including materials science, biological and bio-medical science, and environmental science (e.g., polymers, nanomaterials, magnetic materials, biological materials, aerosols, minerals).

Here, several examples of different systems under study are presented. The overview addresses topics ranging from fundamental environmental chemistry to phase-change microcapsules.

CPP 9.16 Mon 16:00 Poster B

Influence of Temperature, pH and Ionic Strength on the Swelling-Behavior of New Poly(N-isopropylacrylamide-co-allylacetic acid) Microgels — •Matthias Karg and Thomas Hellweg — TU Berlin, Stranski-Laboratorium für Physikalische und Theoretische Chemie, Strasse des 17. Juni 124, D-10623 Berlin, Germany

The volume phase transition of colloidal microgels made of N-isopropylacrylamide (NIPAM) is well-studied and it is known that the transition temperature can be affected by copolymerization. A series of poly(N-isopropylacrylamide-co-allylacetic acid) copolymers with different contents of allylacetic acid (AAA) has been prepared using simple surfactant-free emulsion polymerizations. The thermoresponsive behavior of these partciles was studied by means of dynamic light scattering (DLS). Further characterization was done employing atomic force microscopy (AFM), transmission electron microscopy (TEM) and zeta potential-measurements. While the TEM and AFM observations manifest the spherical shape and low polydispersities of the copolymers, the zeta potential measurements provide information about the relative surface charge.
Since these copolymers are much more sensitive to external stimuli such as pH and ionic strength than their pure PNIPAM counterparts the swelling behavior was investigated at two different pH values and different salt concentrations.

CPP 9.17 Mon 16:00 Poster B

Molecular dynamics simulation of the formation of NaCl-nanoparticles in supercritical water — •Norbert Lümmen and Bjørn Kvamme — University in Bergen, Institute for Physics and Technology, Allégaten 55, N-5007 Bergen, Norway

The formation of salt particles in supercritical water happens in both natural hydrothermal environments and industrial processes. Wherever the ocean is deeper than 2800m and heat sources like intrusive basalts are present, water can attain the supercritical state and salt particle formation takes place. The plugging of reactor pipes due to salt formation is a known technological problem in the Supercritical Water Oxidation (SCWO), a proposed method to purify water contaminated with organic waste.

NaCl-nanoparticle formation in supercritical water was investigated by molecular dynamics simulations as a test case for further studies on metal salt formation. The rigid SPC/E water model was employed while the ionic interactions were treated by the model of Smith and Dang. Constant temperature was achieved by a Nosé-Hoover thermostat and the density was chosen to match a system pressure around 25 MPa at different system temperatures and sizes at constant water to ion ratio. Particle formation takes place within a few hundred picoseconds after the jump from ambient to supercritical conditions. After nucleation clusters first grow by adding monomers and later via cluster-cluster-collisions. We present results on the time development of distributions of cluster sizes, compositions, and temperatures, radial distribution functions and an estimate of nucleation rates.

CPP 9.18 Mon 16:00 Poster B

Modelling of Scattering Diagrams — •Adrian Maier, Klaus Nusser, Gerald Johannes Schneider, and Dietmar Göritz — Universität Regensburg, 93040 Regensburg

Scattering methods are most suitable for studying the structure of unknown systems. Especially colloidal objects are of interest for both fundamental and applied science. Therefore an enormous amount of work has been done to extract structure information of such systems out of scattering diagrams. In particular the correlation between the structure of colloidal systems and the scattering diagrams is not fully understood yet. To gain more insight into this topic we numerically calculated scattering diagrams of simple colloidal objects.

In general experimental samples exhibit a significant polydispersity. In models, however, one usually assumes monodisperse particles. Consequently, we investigated the influence of a polydisperse distribution of diameters on scattering diagrams to determine the validity of the analysis.

CPP 9.19 Mon 16:00 Poster B

Macroscopically Thick Silica-Rubber Systems Investigated using GISAXS — •Tobias Pöpperl[1], Gerald Johannes Schneider[1], Peter Müller-Buschbaum[2], and Dietmar Göritz[1] — [1]Institut für Physik, Universität Regensburg, 93040 Regensburg — [2]Physik Department LS E13, TU München

The mechanical properties of filler-rubber systems, with fillers such as e.g. silica, are mainly determined by the filler. In general silica can be interpreted as a fractal object with a hierarchical structure - with structure sizes ranging from nanometers up to several micrometers.

Established methods like Small Angle X-ray Scattering (SAXS) and Ultra Small Angle X-ray Scattering (USAXS) techniques are highly useful for investigating such systems, but cover only structure sizes smaller than one micrometer. Therefore, it is of interest to apply additional methods to expand the accessible range. Originally developed to investigate surface structures of thin films, the powerful technique of Grazing Incidence Small Angle X-ray Scattering (GISAXS) is such a method. It covers the range of a few nanometers up to several micrometers. For the first time GISAXS was used to investigate the morphology of silica dispersed in macroscopically thick rubber and the results are presented.

CPP 9.20 Mon 16:00 Poster B

New well-defined Hybrid Materials with Thermoresponsive PNIPAM-Shells and Inorganic Nanoparticle-Cores — •Matthias Karg[1], Isabel Pastoriza-Santos[2], Luis Liz-Marzán[2], and Thomas Hellweg[1] — [1]TU Berlin, Stranski-Lab., Germany — [2]Universidade de Vigo, Grupo de Quimica Fisica, Vigo, Spain

A simple, emulsion polymerization of N-isopropylacrylamide with the crosslinker N,N'-methylenebisacrylamide leads to spherical hydrogels. Such particles are usually in the submicron size range and are therefore called microgels. Since PNIPAM microgels are thermoresponsive they can be classified as smart materials and have been the topic of several investigations. As these microgels react much faster on external stimuli such as temperature, pH and ionic strength than their macroscopic counterparts they are interesting for different applications including sensors, drug delivery and separation media. Nevertheless the optical properties of organic polymers are poor because of their rather low refractive index. Composite materials made of microgels and inorganic nanoparticles combine the temperature-dependend swelling-behavior of the microgel and the high refractive index of the nanoparticles. We present here the preparation of different types of hybrid systems made of PNIPAM and silica and silica-coated gold nanoparticles. Characterization has been done using dynamic light scattering (DLS), transmission electron microscopy (TEM), scanning electron microscopy (SEM), atomic force microscopy (AFM) as well as UV-VIS-spectroscopy. The results show that well-defined core-shell systems with just one nanoparticle-core can be synthesized.

CPP 9.21 Mon 16:00 Poster B

Downsizing of Silica — •Tobias Pöpperl[1], Gerald Johannes Schneider[1], Matthias Kellermeier[2], Regina Klein[2], and Dietmar Göritz[1] — [1]Institut für Physik, Universität Regensburg, 93040 Regensburg — [2]Institut für Physikalische und Theoretische Chemie, Universität Regensburg, 93040 Regensburg

The mechanical properties of elastomers can be influenced to a large extent by introducing different additives - like the active filler silica. Due to the mixing procedure, changes in the filler morphology can occur - for example downsizing of silica clusters. On the other hand,

some properties of the elastomer may be independent of the additive itself, but linked to specific properties of the polymer chains that are relevant for the restructuring process. However, it is not possible to examine both of these influences entirely indepenent of each other.

To learn more about changes in silica morphology, we studied grinded plain silica. For grinding we used a centrifugal force ball mill and repeatedly extracted samples with advancing grinding time. To investigate the structure development in the so obtained samples we used Small Angle X-ray Scattering (SAXS) and Ultra Small Angle X-ray Scattering (USAXS).

CPP 9.22 Mon 16:00 Poster B

Dependence of the Structure of Carbon Black on its Concentration — •Tobias Sonnleitner, Tobias Pöpperl, Gerald Johannes Schneider, and Dietmar Göritz — Institut für Physik, Universität Regensburg, 93040 Regensburg

The properties of polymer carbon black compounds strongly depend on the nano scale structure of carbon black. Preliminary experiments showed that for the purpose of investigating the detailed surface structure of nanoparticles small angle x-ray scattering (SAXS) and ultra small angle X-ray scattering (USAXS) are very suitable. The accessible length scales ranges from $d_{min} = 5\,\mathrm{nm}$ to $d_{max} = 650\,\mathrm{nm}$. In this work we investigated samples of furnace carbon black N356, dispersed in a SBR 1500 matrix. We used filler contents ranging from 9 to 22 percent in volume. The results prove that there are no changes in the overall surface structure due to the filler degree. In the regime of larger length scales one finds a correlation between the mass fractal dimenson and the filler loading of N356: The mass fractal dimension of the aggregates is reduced if the filling degree is increased.

CPP 9.23 Mon 16:00 Poster B

Contribution of Carbon Black Features to Tunnel Current — •Tobias Sonnleitner and Dietmar Göritz — Institut für Physik, Universität Regensburg, 93040 Regensburg

To get information concerning conductor insulator compounds such as rubber, one possibility is the dielectric spectroscopy. By measuring the dielectric constant of a compound as a function of the frequency of the applied electrical field one gets various information about the sample. On the one hand dielectric experiments deliver information on the conductance of the sample, and on the other hand information on the static limit of the dielectric function. The static limit of the dielectric function in case of higher filling degrees is linked to the amount of polymer chains between the filler particles. And again, the contribution of tunnel currents to the conductance of the sample is linked to the amount of rubber in between the filler particles. We investigated different carbon blacks (N326, N330, N339, N356) in a SBR 1500 matrix. The results of the experiments show that the amount of rubber in between the filler particles and the influence of tunnel currents are linked to a well known carbon black characteristic, the specific surface of the carbon black: greater specific surfaces lead to greater amounts of rubber in between the filler particles and hence a lower contribution of tunnel currents to the conductance of the sample.

CPP 9.24 Mon 16:00 Poster B

Ultra Small Angle X-Ray Scattering Investigation of Colloidal Crystals in Latex Films — •Rainer Gehrke and Stephan Volkher Roth — HASYLAB at DESY, Notkestr. 85, D-22603 Hamburg, Germany

Films obtained from coagulated dispersions of core-shell particles with a rigid thermoplastic core (polystyrene) and a soft elastomeric shell (polymethyl methacrylate-polyethylacrylate) form partially ordered structures which behave like photonic crystals [1]. This behaviour depends on the size of the particles. Samples with different particle size ranging from 200 nm to 300 nm have been characterized by means of Ultra Small Angle X-ray Scattering using synchrotron radiation at HASYLAB beamline BW4. In a layer near the film surface the particles form a regular fcc lattice with the (111) netplanes parallel to the surface. This ordering causes Bragg-like reflections in the scattering pattern. The material in-between the layers shows a scattering contribution caused by strong distance correlation without orientational ordering. From the scattering patterns obtained for different angles between the incoming X-ray beam and the film surface information about the degree of orientational ordering can be derived.

[1] T. Ruhl, G.P. Hellmann, Macromol. Chem. Phys. 202, 3502 (2001)

CPP 9.25 Mon 16:00 Poster B

SAXS studies of choline carboxylate surfactants - soaps of physiological origin and outstanding solubility — •Regina Klein[1], Didier Touraud[1], Gerald Schneider[2], Tobias Pöpperl[2], and Werner Kunz[1] — [1]Institut für Physikalische und Theoretische Chemie, Universität Regensburg, 93040 Regensburg — [2]Institut für Physik, Universität Regensburg, 93040 Regensburg

Surfactants have been used for centuries in everyday life, e.g. for cleaning purposes or for the formulation of foods. The functionality of soaps derives from their amphiphilic molecular structure which is characterized by a polar head group providing water solubility, and a non-polar tail driving the formation of self-assembled aggregates in solution (micelles and liquid crystals). Common anionic soaps, such as alkali carboxylates, are restricted in their applicability due to their limited solubility in water. Important features such as the washing ability or the solubilising power can be improved by increasing the length of the hydrophobic chain. However, the longer the non-polar tail, the less soluble in water the corresponding surfactant is. A way to enhance the solubility of carboxylate surfactants in water and to ensure at the same time biocompatibility of the system is to replace the conventional alkali counter-ion by a quarternary ammonium ion of biological origin, such as choline ((2-Hydroxyethyl)trimethylammonium). Choline - formerly known as vitamin B4 - plays several key roles in the human body. In the present study, phase diagrams of choline carboxylates (C12-C18) have been established. Structural details such as the micellar shape and size were investigated by small-angle X-ray scattering.