alytics, TU Chemnitz, 09107 Chemnitz

The photoinduced decay of fluorescence of organic dyes (photobleaching) is usually discussed in terms of irreversible photochemical modifications of the dye molecules (often photooxidation). We can show now, that the fluorecence decay from a number of dyes is mostly reversible in the initial part. The reversible decay is due to fluorescence intermittency with power law distributed on- and off- intervals (blinking) [1,2].

By measuring the recovery of the initially bleached lumincescence after a given waiting time as a function of the bleaching time we are able to discriminate the reversible and irreversible fraction of the luminescence decay. The finding, that an intermittency induced photophysical bleaching process dominates the initial stages of photobleaching may shine new light on the puzzling variety of data on nonexponential photobleaching kinetics which has been published in the literature on photobleaching during the past decades. Once deconvoluted, the irreversible photochemical bleaching kinetics follows a simple single exponential decay. The photophysical bleaching is assigned to the photoejection of charges into the polymer. This reversible photoionisation process takes place on time scales from milliseconds to minutes.

[1] Schuster et al., Appl. Phys. Lett. 87 (2005), 051915
[2] Schuster et al., J. Luminescence, in press

CPP 18.4 Wed 15:15 H40

Molecular tracer diffusion in thin azobenzene polymer layers — •Norman Mechau[1,3], Marina Saphiannikova[2], and Dieter Neher[1] — [1]Institute of Physics, University of Potsdam, Am Neuen Palais 10, 14469 Potsdam, Germany — [2]Leibniz Institute of Polymer Research, Hohe Straße 6, 01069 Dresden, Germany — [3]Forschungszentrum Karlsruhe, Institut of Nanotechnology, 76021, Karlsruhe, Germany

Translational diffusion of fluorescent tracer molecules in azobenzene polymer layers is studied at different temperatures and under illumination using the method of fluorescence recovery after photo-bleaching. Diffusion is clearly observed in the dark above the glass transition temperature, while homogenous illumination at 488 nm and 100 mW/cm^2 does not cause any detectable diffusion of the dye molecules within azobenzene layers. This implies that the viscosity of azobenzene layers remains nearly unchanged under illumination with visible light in absence of internal or external forces.

CPP 18.5 Wed 15:30 H40

Ortsaufgelöste Messung der thermischen Leitfähigkeit in Flüssigkeiten* — •Judith Schwesyg, Helge Eggert, Dirk Apitz und Karsten Buse — Physikalisches Institut, Universität Bonn, Wegelerstr. 8, 53115 Bonn

Bildgebende Verfahren sind in vielen Bereichen der Wissenschaft und Technik von fundamentaler Bedeutung. Hierbei werden verschiedenste Kontrastmechanismen benutzt, z. B. Absorptions-, Brechungsindex- und Temperaturunterschiede. Ein neuer Ansatz ist, als Kontrast Inhomogenitäten der Wärmeleitfähigkeit in Flüssigkeiten oder Festkörpern zu messen und bildlich darzustellen. In diesem Vortrag wird ein pulsholographisches Verfahren vorgestellt, mit dem es gelingt, die thermische Leitfähigkeit in Flüssigkeiten ortsaufgelöst zu messen. Es basiert auf der Tatsache, dass vom Zerfall thermischer Gitter, die durch Beleuchtung mit zwei interferierenden Nanosekundenlichtpulsen erzeugt wurden, auf die thermische Leitfähigkeit geschlossen werden kann. Als Beispielsystem dient das Zweikomponentensystem Toluol-Wasser. Es werden Messergebnisse sowie die aus diesen erstellten zweidimensionalen Bilder präsentiert. Des Weiteren tritt durch die Pulsbeleuchtung ein Grenzflächeneffekt auf: Von der Grenzschicht gehen aufgrund unterschiedlicher Material-Kompressibilitäten Schallwellen aus, die durch Beugung nachgewiesen werden. Dieser Effekt kann ebenfalls zur Bildgebung genutzt werden.

*Wir danken der Deutschen Forschungsgemeinschaft (BU 913/17), der Deutschen Telekom AG und der Deutschen Telekom Stiftung für die finanzielle Unterstützung.

CPP 19: POSTER: Micro and Nano Fluidics

Time: Wednesday 16:00–18:30 Location: Poster B

CPP 19.1 Wed 16:00 Poster B

Cantilever micro rheometer for measurement of sugar solutions — •Marc Hennemeyer and Robert Stark — Dept. Geo und Umwelt, Ludwig-Maximilians-Universität, Theresienstr. 41, 80333 München

Measurement of rheological properties of liquids is of high interest in many areas like medicine and biology. As traditional measurement techniques require relatively big amounts of sample fluid, the last years have seen an increased interest in the miniaturization of measurement tools. Micro mechanical sensors as used in atomic force microscopy are ideally suited as sensors in micro fluidic devices. Although the vibration of cantilevers does not respond to viscosity changes of fluids on macroscopic scales, micrometer scaled plates are affected by the viscous properties of the surrounding fluids. In this work a simple measurement tool for the rheological measurements on arbitrary Newtonian liquids is presented which is based on the analysis of stochastic cantilever oscillations. The system can be operated with standard consumer computer hardware, which dramatically reduces the costs for the system. The system presented in this work is a very cost effective set up that can be used for a wide range of experiments in cost sensitive environments. It could be shown, that for viscosity measurements on basis of the method introduced by Sader, standard computer hardware can be used to substitute expensive data acquisition hardware. The measurements on sugar solutions could evaluate the viscosity and density of the solutions to an accuracy of about 10%.

CPP 19.2 Wed 16:00 Poster B

Dewetting dynamics of thin polymer films on topographic and elastic substrates — •Konstantina Kostourou, Krishnacharya Khare, Martin Brinkmann, Stephan Herminghaus, and Ralf Seemann — Max Planck Institute for Dynamics and Self-Organization, D-37073 Göttingen, Germany

Dewetting dynamics of polymer films in triangular grooves and on elastic substrates are studied experimentally and theoretically. Liquid filaments, in triangular grooves, with convex liquid-vapor interface are unstable and undergo dynamic instability resulting in equally spaced individual droplets with a preferred distance. This instability is driven by the local variation of the Laplace pressure with filament width and resembles a generalized Rayleigh-Plateau instability. From the time scale of the dynamic instability we extract slip properties of the polymer/substrate interface. Additionally we study the dewetting dynamics of thin polymer films on rubber elastic substrates. Here, the dynamics are additionally determined by the dissipative properties of the elastic substrate. We compare the flow behavior of liquid polymer films on substrates of different visco-elasticity and constant wettability. Our experiments show that dewetting is faster on substrates with larger elastic modulus.

CPP 19.3 Wed 16:00 Poster B

Raman spectroscopy on periodic mesoporous organosilica with different pore sizes — •Martin Andreas Schreiber[1], Martin Güngerich[1], Wolfram Heimbrodt[1], Torsten Henning[2], Peter Jens Klar[2], Vivian Rebbin[3], Michael Fröba[3], Lutz Eichhorn[4], Jürgen Brandner[4], and Klaus Schubert[4] — [1]Dept. Physics and WZMW, Philipps University of Marburg, Germany — [2]1. Physics Institute, Justus-Liebig-University of Gießen, Germany — [3]Institute of Inorganic and Analytical Chemistry, Justus-Liebig-University of Gießen, Germany — [4]Forschungszentrum Karlsruhe, IMVT, Eggenstein-Leopoldshafen, Germany

Periodic mesoporous organosilica (PMOs) are organic-inorganic hybrid materials with regular pore systems and well-defined pore sizes in the range of 3 to 15 nm yielding inner surfaces of about 1000 m^2/g. Two-point attached organic units within the silica matrix in the pore walls are a genuine part of the 3D pore wall framework. These organic functionalisations is very versatile making these hybrids interesting for applications in catalysis and micro-reactor technology.

Here we study the adsorption and desorption behavior in dependence of the pore-size of benzene-functionalized and ethane-functionalized PMOs in the temperature range between 20 and 140°C by Raman spectroscopy. We find significant differences in the adsorption-desorption

behaviour for the solvents ethanol and benzene suggesting that PMOs make a selective separation of solvent vapours possible.

CPP 19.4 Wed 16:00 Poster B

Mechanical properties of wet granular matter — •Mario Scheel, Martin Brinkmann, Stephan Herminghaus, and Ralf Seemann — MPI for Dynamics and Self-Organization

The macroscopic mechanical properties of a dry granulate change dramatically when small amounts of liquid are added. This is due to capillary bridges forming between mutually adjacent grains in the pile, which exert an attractive force by virtue of the surface tension of the liquid. The mechanical properties of a wet model granulate consisting of glass spheres with a narrow size distribution are studied. We determine the critical fluidization acceleration for vertical agitation, the tensile strength, and the yield stress of the granulate for various liquid contents. We compare the results from these different methods with each other and discuss them in the framework of structural information extracted from x-ray tomography images of granulates, i.e. the packing density and the liquid distribution. In-situ x-ray tomography experiments reveal furthermore insights into the redistribution of the liquid within a sheared granulate and the redistribution of liquid within a formerly fluidized granulate.

CPP 19.5 Wed 16:00 Poster B

A Study on the Permeability of Nanoporous Vycor — •Simon Grüner[1], Stefanie Greulich[1], Dirk Wallacher[2], and Patrick Huber[1] — [1]Saarland University, Saarbrücken, Germany — [2]Hahn-Meitner Institute, Berlin, Germany

We have designed and built a membrane flow apparatus (MFA) to measure the liquid permeability K of porous monoliths such as nanoporous Vycor as a function of applied pressure difference ΔP ($0 < \Delta P <$ 70bar), temperature T and pore wall chemistry (silanization). The pore structure of the matrix (mean pore diameter $d \approx 8$nm, porosity $\phi \approx 30\%$) is characterized by nitrogen sorption isotherms at $T = 77$K.

First measurements of the volume flow rate $\dot{V}$ of n-hexane through Vycor at $T = 18°$C nicely confirm Darcy's law, that is $\dot{V} \propto \Delta P$. Nonetheless the derived permeability K is somewhat smaller than expected from calculations assuming the above mentioned values for ϕ and d. We rather obtain a best agreement between experiment and theory with a pore radius 0.4nm smaller than that derived from the sorption isotherm. This reduction corresponds to about one immobile monolayer (boundary layer) of lying hexane molecules at the wall.

This work has been supported by the DFG within the priority program 1164 (HU850/2-1).

CPP 19.6 Wed 16:00 Poster B

Discrete Microfluidics: Combinatorial Chemistry with Emulsions — •Venkatachalam Chokkalingam, Craig Priest, Stephan Herminghaus, and Ralf Seemann — Max Planck Institute for Dynamics and Self-Organization, D-37073 Göttingen, Germany

Microfluidics usually involves single phase liquids transported through microchannel networks. Instead of single phase flow we explore a droplet based discrete microfluidics for possible applications in combinatorial chemistry. The online generation of highly monodisperse emulsions in a single step is studied to compartment liquids within microchannels. Furthermore, we explore the manipulation of monodisperse emulsions using the distinct interaction of the internal length scale of the liquid (drop diameter) with the external provided geometry of the microchannels for positioning, sorting, dividing and exchanging droplets in 'lab-on-chip' style processing. Coalescence between adjacent compartments can be induced applying an electrical potential of a few volts across their lamella. As a first approach towards combinatorial chemistry we study all possible volumetric combinations of two chemicals. Adjusting the temporal concentration of the two chemicals accordingly to the channel geometry down stream when injecting them into the microfluidic channel leads to a 2D reaction library where the two concentration gradients vary along the x- and y-axis, respectively.

CPP 19.7 Wed 16:00 Poster B

Thermally Excited Capillary Waves on a Surface Frozen Liquid: A GIXPCS Study — P. Huber[1], •M. Wolff[1], V. Schoen[1], M. Deutsch[2], E. Sloutskin[2], B. Ocko[3], J. Baumert[3], A. Madsen[4], and M. Sprung[5] — [1]Universitaet des Saarlandes, Saarbruecken, Germany — [2]Bar-Ilan University, Ramat-Gan, Israel — [3]Brookhaven National Laboratory, NY, United States — [4]European Synrchoton Radiation Facility, Grenoble, France — [5]Advanced Photon Source, Argonne National Laboratory, United States

We present results of grazing incidence x-ray photon correlation spectroscopy (GIXPCS) measurements on thermally-excited capillary waves at the free surface of a tetracosane ($C_{24}H_{50}$) melt as a function of temperature. The measurements have been carried out at the ESRF, Grenoble, France and APS, Argonne National Laboratory, USA.

Upon surface freezing - the formation of a single crystalline monolayer at the melt's surface, close to, but above the bulk solidification temperature - we find a change both in the damping and in the dispersion relation of the capillary waves.

Our findings on the behavior of *microscopic* capillary waves, presented here, corroborate earlier results regarding the changes in the dynamics of *macroscopic* capillary waves upon surface freezing [1].

[1] P.Huber et al., Physical Review Letters **94**, 184504 (2005)

CPP 19.8 Wed 16:00 Poster B

Rheological and structural phase diagrams of salted solutions of the tri-block copolymer EO_{20}-PO_{70}-EO_{20} — •Nicole Voss[1], Marco Walz[1], Max Wolff[2], and Andreas Magerl[1] — [1]Chair for Crystallography and Structural Physics, University of Erlangen-Nürnberg, Staudtstr. 3, 91058 Erlangen — [2]Chair for Condensed Matter Physics, Ruhr-University Bochum, Universitätsstr. 150, 44780 Bochum

Aquaeous solutions of tri-block copolymers have well known rich phase diagrams of ordered structures which can also be identified through rheometry. We have studied the influence of adding electron-rich salts with concentrations up to 1.5 mol/dm^3 on the phase diagram of the tri-block copolymer Pluronic® P123 (central block of 70 propylene oxide units terminated by two end groups of 20 ethylene oxide units). While the morphology of the phase diagram is preserved, a linear shift of -12°C per 1 mol/dm^3 CsCl is observed for the phase boundary of the cubic phase with high viscosity. The results are interpreted by the modification of the water structure, i. e. the ions of CsCl surround themselves with hydration shells and also dehydrate the PPO block. This mechanism decreases the solubility of the polymer and favours micellization at lower temperatures.

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CPP 19.9 Wed 16:00 Poster B

Shear flow pumping in open microfluidic systems — •Markus Rauscher[1,2], Siegfried Dietrich[1,2], and Joel Koplik[3] — [1]Max-Planck-Institut für Metallforschung, Heisenbergstr. 3, 70569 Stuttgart — [2]Institut für Theoretische und Angewandte Physik, Universität Stuttgart, 70569 Stuttgart — [3]Benjamin Levich Institute and Department of Physics, City College of the City University of New York, New York, NY 10031, USA

We propose to drive open microfluidic systems by shear in a covering fluid layer, e.g., oil covering water-filled chemical channels. The advantages as compared to other means of pumping are simpler forcing and prevention of evaporation of volatile components. We calculate the expected throughput for straight channels and show that devices can be built with off-the-shelf technology. Molecular dynamics simulations suggest that this concept is scalable down to the nanoscale.

CPP 19.10 Wed 16:00 Poster B

Dynamics of droplets on open microfluidic Y-junctions — •Fabian Dörfler[1,2], Markus Rauscher[1,2], and Siegfried Dietrich[1,2] — [1]Max-Planck-Institut für Metallforschung, Heisenbergstr. 3, 70569 Stuttgart — [2]Institut für Theoretische und Angewandte Physik, Universität Stuttgart, 70569 Stuttgart

We investigate the dynamics of droplets on chemical channels with Y-junctions driven by body forces. Chemical channels are wetting stripes on otherwise non-wetting surfaces in which liquids can be guided.

We analyse the energy of a droplet in the vicinity of a junction in a capillary model in quasistationary approximation. We investigate the pinning of the droplets in the junction and from the local contact angle we determine thresholds for the spilling of droplets onto the non-wetting substrate.

CPP 19.11 Wed 16:00 Poster B

Correlating macroscopic viscosity and microscopic structure of the tri-block copolymer EO_{20}-PO_{70}-EO_{20} — •Marco Walz[1], Max Wolff[2], Nicole Voss[1], Andreas Magerl[1], and Hartmut Zabel[2] — [1]Chair for Crystallography and Structural Physics, University of Erlangen-Nürnberg, Staudtstr. 3, 91058 Erlangen, — [2]Chair for