# CPP 3 SYMPOSIUM: Dynamics of multi-component fluids III

Zeit: Freitag 14:00–15:15 Raum: TU C243

## Hauptvortrag

CPP 3.1 Fr 14:00 TU C243

**Rheology and morphology of multiphase polymer blends** — •Martin Laun[1], Marian Mours[1], Inge Vinckier[2], Filip Osterlink[2], and Paula Moldenaers[2] — [1]BASF Aktiengesellschaft, Ludwigshafen/Rhein — [2]KU Leuven, Belgium

The rheology and processing behaviour of multiphase polymer blends strongly depend on their phase morphology. The latter is affected by the rheological properties of the polymer components, their interfacial characteristics as well as by the flow conditions during blending/processing. Intelligent blend processing and material selection requires insight in the interrelations between material parameters, process variables and resulting morphology. The interplay between rheology and morphology in simple shear flow is demonstrated on LCST technical model blends of P$\alpha$MSAN and PMMA, which allow the creation of various morphologies for a given composition. Phase separation and coarsening as monitored by oscillatory shear, can quantitatively be described by the Palierne model (droplet matrix morphology) and the Doi-Ohta theory (co-continuous structures. Droplet deformation, break-up and coalescence in steady shear were monitored by the transient normal stress and subsequent oscillatory shear measurements. More complex and processing related flows like filament extension, extrusion through a capillary or squeezing flow were investigated on immiscible model blends of PMMA and PS. Droplet morphology development after elongation is significantly affected by the viscoelasticity of the disperse phase. Thin fibrils may be obtained due to a suppression of the Rayleigh instability during elongational flow.

CPP 3.2 Fr 14:30 TU C243

**Immiscible blends compatibilised by triblock terpolymers - Correlation of molecular architecture of block copolymers with morphology and properties** — •Holger Ruckdäschel[1], Jan K.W. Sandler[1], Axel H.E. Müller[2], and Volker Altstädt[1] — [1]Polymer Engineering, University of Bayreuth, Universitätsstrasse 30, 95447 Bayreuth, Germany — [2]Macromolecular Chemistry II, University of Bayreuth, Universitätsstrasse 30, 95447 Bayreuth, Germany

Polymer blends such as poly(2,6-dimethyl-1,4-phenylene ether) (PPE) and poly(styrene-co-acrylonitrile) (SAN) are often immiscible, resulting in a rough and disperse morphology. The incompatibility leads to a reduction of properties such as toughness, due to low interphase strengths. Block copolymers are often used as coupling agents to improve the miscibility of the polymers. Poly(styrene)-block-poly(butadiene)-block-poly(methyl methacrylate) triblock terpolymers (SBM) are particularly useful as a compatibiliser in PPE/SAN blends. The interaction between the components results in the formation of a so-called nanostructured 'raspberry' morphology. Although the basics of solvent-mediated processing have been investigated, melt processing of such materials is more complicated, due to the number of increasing parameters. The triblock terpolymer concept requires a reproducible and stable morphology, which can only be achieved through a basic understanding and systematic monitoring of the relevant processing and the materials parameters. In this study, the effects of block lengths and concentration of SBM on the resulting morphology have been correlated with the processing behaviour and the micromechanical properties of the blends.

CPP 3.3 Fr 14:45 TU C243

**Thermal patterning of a critical polymer blend** — •Werner Köhler, Wolfgang Enge, Albert Voit, Alexei Krekhov, and Lorenz Kramer — Physikalisches Institut, Universität Bayreuth

We have employed a moderately focused laser beam (30 $\mu$m, 20 mW) to write spatial composition patterns into layers of the critical polymer blend poly(dimethyl siloxane)/poly(ethyl-methyl siloxane) (PDMS/PEMS, $M_w$ = 16.4/22.3 kg/mol) both in the one and in the two phase region a few degrees above and below the critical temperature $T_c = 37.7\,°C$. Due to the critical divergence of the Soret coefficient, moderate temperature gradients are sufficient to induce composition modulations of large amplitude. In the two phase regime the spinodal demixing pattern can be locally manipulated in a controlled way. 2D-simulations based on a modified Cahn-Hilliard equation are able to reproduce the essential spatial and temporal features observed in the experiments.

CPP 3.4 Fr 15:00 TU C243

**Juggling with Droplets: Digital Microfluidics** — •Craig Priest, Dmytro Melenevsky, Stephan Herminghaus, and Ralf Seemann — MPI for Dynamics and Self-Organization, D-37073 Göttingen

Microfluidics is usually concerned with single phase liquids transported along solid microchannels. We explored to use emulsions as compartmented liquids instead of a single phase flow. If the continuous phase has a very small volume fraction, the emulsion is geometrically quite analogous to a foam and the position of each liquid compartment in the arrangement is well defined, provided all compartments have about the same size. The main issue here is the interplay of the internal length scale of the fluid, i.e., the size of the liquid compartments (droplets), with the lateral dimension of the channels. While it is well known from millimetre scale foam that this interaction is very well defined, a major question concerns the scalability of this concept to the micron regime. As a first approach, we produced emulsions in situ on the length scale of several 100 microns in a microfluidic device. We exploited the mentioned possibility of manipulation of the droplets by the channel geometry for positioning, sorting, exchanging, compiling and redistributing them. We furthermore demonstrated the possibility of merging droplets and inducing chemical reactions within compartments with different chemical contents. This may be called digital microfluidics, and will be well suited for applications in combinatorial chemistry, DNA sequencing, drug screening, and any other field where many similar chemical reactions have to be induced with minute amounts of substance.