PEP-PEO block copolymer micelles: Equilibrium and non-equilibrium structures determined by SANS

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We study the influence of external shear on aqueous solutions of the micelle forming block copolymer poly(ethylene-alt-propylene) (PEP) - poly(ethylene oxide) (PEO). The molar characteristics of PEP-PEO block copolymers can be controlled by modern anionic polymerisation techniques yielding low polydispersities and predefined molar masses and compositions. In water as selective solvent for PEO the block copolymer forms kinetically frozen micelles. Their structure and interaction can be tuned smoothly from star-like (=**ultra-soft**) to **hard-sphere**-like by varying the length of the PEO-block. In the star-like regime, the aggregation number of the micelles can be tuned by addition of dimethylformamide (DMF), which primarily reduces the interfacial tension between the insoluble PEP-core and the solvent. In this study we took advantage of these properties by using the PEP-PEO in water and water/DMF mixtures as tunable colloidal model system. Two block copolymers have been investigated: a PEP1-PEO20 (**ultra-soft**) and PEP4-PEO4 (**hard-sphere** like), where the numbers denote the molecular weights of the respective blocks in kg/mol.

The combination of SANS and rheology can give insight in the correlation between structure factor and the flow properties of the mixtures. This task is experimentally demanding, because it requires the appliance of high shear stresses. Most of the standard rheometers cannot be operated at these desired high shear rates. To overcome these problems we designed a new rheometer in Couette-geometry. We will give some information on this new instrument. Furthermore we will present our results on the equilibrium form- and structure factors and show the influence of shear on samples of PEP1-PEO20 and PEP4-PEO4.