Temperature sensitive microgels in internal and external fields

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Environmentally sensitive polymers are an important class of complex fluids with applications in different fields as e.g. in sensors, catalysis and controlled drug release. Aqueous microgel suspensions with a strong sensitivity of particle size on temperature can be prepared based on poly-N-isopropyl acryl amide. The microgel particles shrink upon heating and eventually phase separation occurs. Structural changes were investigated by means of light scattering and small angle neutron scattering (SANS). A model expression for the intensity distribution function was derived and employed to fit the experimental data providing real space information about the internal particle shape as well as the solution structure.

The influence of shear flow on the phase behavior was investigated by means of rheo-optics and rheo-SANS. At low temperature rheo-SANS shows a shear induced layer formation. In addition a shear induced shift of the miscibility gap was found. By employing different particle sizes it was possible to observe the internal structure of the particles as well as the shear induced aggregation. Furthermore the influence of cross link density within the microgel particle on the shear induced phase separation was studied.

An even higher variability of materials properties can be achieved with core-shell microgels. Core-shell microgels composed of two polymers with different switching temperatures lead to systems which exhibit two transitions temperatures. The step height can be adjusted via the cross linking density or the ratio of masses of core and shell, respectively. Such systems are characterized by a core-shell interface with opposite mechanical forces when the temperature is changed.