Structure and Rheology of Thermoresponsive Colloidal Molecules (TCM)

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Compared to spherical colloids, shape anisotropic particles show additional degrees of freedom in the highly diluted state as well as in the concentrated regime. They are used as model systems in soft matter physics. In this contribution, the microgels (TCM) carry a thermoresponsive network of crosslinked poly-(N-isopropylacrylamide) which facilitates a change of their length to diameter ratio from ca. 1.3 to 1.6 by tuning the temperature. Cryogenic transmission electron microscopy (cryo-TEM), depolarized dynamic light scattering and the shell model served to analyze the structure in solution (Figure 1). [1]

Figure 1: Cryo-TEM micrograph of the TCMs (a). Morphology of the TCMs in solution as a function of the temperature (b).

The first experiments on the rheology of the TCMs indicate that the glass transition takes place at considerable higher particle volume fractions (φeff) compared to the spherical core-shell microgels (Figure 2). Interestingly, upon reaching the glassy state, there is no change in the loss modulus (G'') within experimental error at low frequencies (ω).[2]

Figure 2: Normalized storage (G') and loss modulus (G'') as a function of the reduced frequency ω for different temperatures and volume fractions. V is the particle volume, L = 2R + Lh (compare Figure 1) and D0 is the translational diffusion coefficient.