

Depletion interaction in binary mixtures of thermoresponsive microgels

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Thermoresponsive microgels are intriguing colloids that exhibit a rich phase behavior due to their unique soft potential and swelling behavior. The thermoresponsive swelling behavior of microgels allows us to use the temperature as an external control to vary the volume fraction and softness of the particles *in situ*. Here we report on an investigation of the structural correlations of soft microgels with a radius $R(15^{\circ}\text{C}) = 440$ nm in the presence of a second population of small microgels ($R(15^{\circ}\text{C}) = 29$ nm) through confocal laser scanning microscopy. We combine this with computer simulations in order to probe the effective interaction potential and the resulting structural correlations as a function of temperature and concentration.

We observe the presence of an additional attraction between the big microgels due to the depletion effect arising from the addition of small particles. Since the two types of microgels have similar swelling behavior, we can use temperature to change the effective volume fraction and the softness of the particles, while keeping the size ratio constant. When compared to the depletion effect caused by small microgels in hard sphere suspensions, the presence of the small particles influences the radial distribution function ($g(r)$) of the large microgels very differently: instead of a pronounced peak increase (indicative of attraction, seen for hard spheres), the microgels show smaller center-to-center distances but no significant peak increase. We discuss our findings in view of the particular internal core shell architecture of the microgels, and their ability to de-swell, deform and/or interpenetrate.

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