Heterogeneous nucleation of soft spheres

J. Dubbert1*, K. Sandomirski2, S. Walta2, T. Eckert1, S. Egelhaaf1 and W. Richtering1

1 Institute for Physical Chemistry, RWTH Aachen University, Landoltweg, Germany
2 Heinrich Heine University Düsseldorf, Universitätsstraße, Germany
*e-mail: Dubbert@pc.rwth-aachen.de

The homogeneous crystallization process of hard (e.g. PMMA) and soft spheres has been studied extensively [1,2]. However, knowledge concerning the heterogeneous nucleation of both is still rare. Fluorescently labelled PNIPAM (poly-N-isopropylacrylamide) microgels provide a model system which allows the investigation of heterogeneous crystallization behaviour of soft particles via confocal microscopy. Microgels and hard spheres show several differences. Microgels are swollen by a solvent and show temperature-dependent sizes (Fig 1). Usually, the segment density decays smoothly towards the particle surface. Therefore microgels are compressible particles with a fuzzy interface. To compare the crystallization behaviour of microgels and hard spheres we synthesized PNIPAM particles in a semi-batch approach with a relative homogeneous surface.

Temperature dependent size (left) and measured form factor at 20°C (right) measured with dynamic and static light scattering under dilute conditions. The red line represents a fit of a model for polydisperse soft spheres[4].

If a curved seed is present during the process of heterogeneous nucleation it introduces strain in the crystal lattice which has to “bend” around the seed [3]. Our investigations focus on the effect of the size ratio as well as the structure and softness of the seed particle on the crystal formation.

Confocal images of PNIPAM (A) crystallized on a flat wall (B) in the presence of a microgel bead as seed particle and (C) on a droplet of perfluorhexane. A so decorated droplet can act as a soft nucleation seed.