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Report:
SC867- Micro-Structure and Kinetics of 'Transient' Gels

In the SC867 experiment we have investigated the structural evolution of 'Transient gels'. Those samples are formed by adding a non-adsorbing polymer (polystyrene, PS) to sterically-stablised colloid particles (Polymethylmethacrylate, PMMA) [1,2]. Under a deep ($> 5k_B T$) and narrow depletion attraction due to presence of polymer, particles aggregate rapidly to form a ramified, space-filling structure [3]. This highly-non-equilibrium structure, however, evolves, until spatial connectivity is lost and the gel collapses [4]. The evolution of static structure factor during the gel formation and collapse was investigated by Bonse-Hart USAXS.

The most important structural evolution for this system is reported in Figure 1. This evolution, from dilute colloidal suspension to 'strong' transient gel at the some volume fraction of colloids (ϕ = 0.2), is very pronounced.

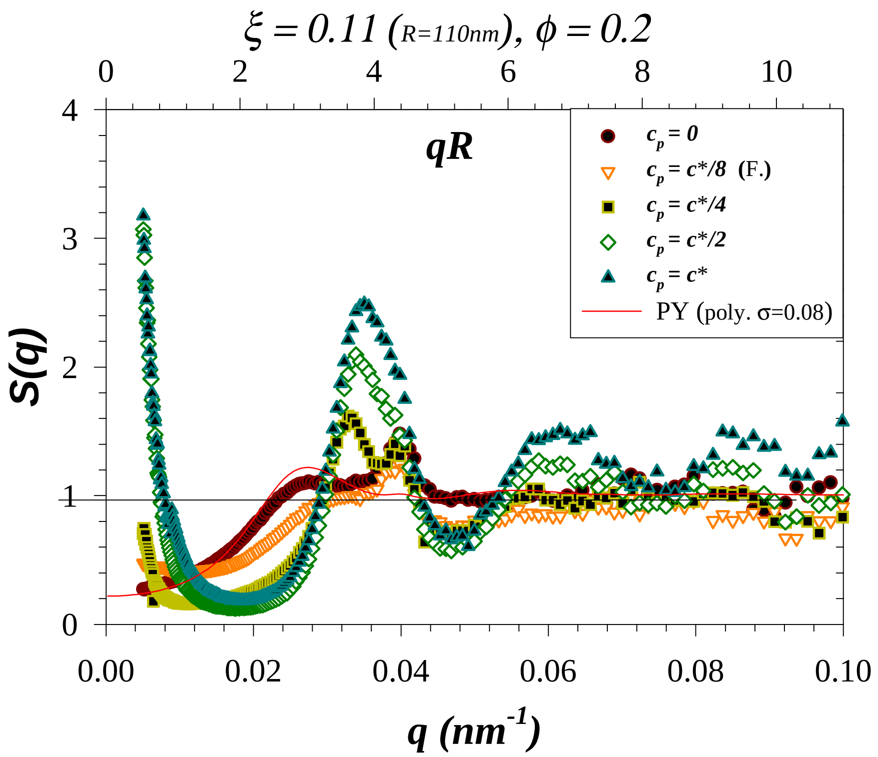

Fig. 1 Measured structure factor S(q) from for colloidal-polymer mixtures at ϕ=0.2 and different polymer concentration c_p. The solid line represents the theoretical Percus-Yevick theory prediction.

The Measured S(q) shows a pronounced peak at QR around 3.5 and a rise at small Q. The latter represents the beginnings of the small-angle light scattering ring already observed (3).

This is a reasonable description of a freshly-formed transient gel. We identify the increase of the small-angle scattering intensity with the formation of large aggregates.

The well-developed peak in S(Q) at $3.2 \leq QR \leq 3.9$, (corresponding to a packing fraction $\phi \approx 0.56$) is a strong evidence of the existence of compact structure (on the scale R_{min} = a few particle diameters). Our system behaves like a hard-sphere glass at $\phi \approx 0.62$.

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