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Single-Particle Tracking of the Formation of a Pseudo-Equilibrium State Prior to Interfacial Charged Microgel Cluster Formation

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Abstract

The interaction between micron-sized particles and their self-assembly properties at fluid interfaces are important in several applications including the stabilization of Pickering emulsions and creation of colloidosomes. In this study, through real time visualization of the diffusion of microgel particles at the air-water interface of an aqueous pendant drop, the formation of a pseudo-equilibrium state is observed prior to particle coalescence. It is shown here that at the microscopic level, a pendant drop surface has non-uniform principal curvatures and exhibits positive deviatoric curvature ($+\Delta c$) gradients. The $+\Delta c$ gradients confer super-diffusive motion to single ionic microgel particles and are responsible for bringing particles, initially far apart, to common sites on the interface with high curvatures. Prior to two-particle cluster formation, the balance between pair-wise repulsion, capillary attraction and $+\Delta c$ -induced energy pushing the pair of particles to high curvature creates a pseudo-equilibrium state where the inter-particle distance remains relatively invariant for a long period of time. This observation is also noted during higher cluster formation. Thereafter, a sufficiently strong long-ranged attraction potential is activated to facilitate cluster formation. The real-time tracking of the evolution of cluster formation provides useful insights into the interplay between various interactions experienced by the ionic microgels.

Keywords: Wide-field microscopy, micorgel, cluster formation, curve interface

Reference:

[1] W. Bi and E. K. L. Yeow, Single-Particle Tracking of the Formation of a Pseudo-Equilibrium State Prior to Interfacial Charged Microgel Cluster Formation, *NPG Asia Mater.*, in-press.