Investigation of interaction across the thin liquid film of colloidal suspensions by CP-AFM

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The origin of the oscillatory force is due to the entropic excluded volume effect in confined thin films. The confinement induces a layered ordering of colloidal particles in the vicinity of the confining surfaces, indicating that the translational symmetry of the bulk system is broken. Therefore, studying the oscillatory force is a direct way to understand the interaction between colloidal particles and control the stability and other properties of the colloidal suspension.

Here we perform force measurements by using Colloidal Probe Atomic Force Microscopy (CP-AFM), in which the colloidal probe on the cantilever and the substrate act as the confining surfaces. The force can be determined by following the change of the cantilever deflection and is normalized with the colloidal probe radius. The effects of particle concentration, particle size and ionic strength on the interaction between colloidal particles were studied. The characteristic lengths in the confined thin film are in good agreement with those obtained from the corresponding free volume case using Small Angle X-Ray Scattering.

Beside this classical, symmetrical setup the CP-AFM can also be used to create an asymmetric confinement by measuring against an air-bubble, instead of a silicon wafer, allowing to study the interactions in this new environment and to illuminate the influence of surface deformability.