Depletion forces present between silica particles in solutions of polyelectrolytes

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Various industrial applications including papermaking and water treatment require knowledge of the properties of particle suspensions, such as their stability and rheology. These parameters can be modified by the addition of polyelectrolytes.

Our research concentrated on the interaction forces between silica particles measured in aqueous solutions of poly(2-vinylpyridine) (P2VP), poly(L-lysine hydrobromide) and polyamidoamine (PAMAM) dendrimers using the colloidal probe technique based on an atomic force microscope (AFM). The observed forces were described by a superposition of damped oscillatory forces and double layer forces quantitatively. The double layer forces were modeled using Poisson–Boltzmann (PB) theory for a mixture of a monovalent symmetric electrolyte and a highly asymmetric electrolyte, whereby the multivalent coions represent the polyelectrolyte chains.

Results of our investigations show that the polyelectrolyte concentration change has an influence on the parameters characterizing oscillation forces. We also proved that the increasing roughness of the silica particles deriving from the adsorbed cationic polyelectrolyte does not influence the presence of the oscillatory forces.