

28d Colloidal Stabilisation by Nano-Particle Halos

Ard Louis

We explore the conditions under which colloids can be stabilized by the addition of smaller particles. The largest repulsive barriers between colloids occur when the added particles repel each other with soft interactions, leading to an average accumulation near the colloid surfaces. At lower densities these diffuse layers of mobile particles (nanoparticle halos) result in stabilization, but when too many are added, the interactions become attractive again. We systematically study these effects -accumulation repulsion, re-entrant attraction, and bridging - by accurate and flexible integral equation techniques[1], which faithfully reproduce recent computer simulations of the same effect[2]. We can explain recent experiments[3], and moreover show that there is a very substantial parameter regime where nanoparticle halos lead to colloidal stabilisation. We argue that this new mechanism should be widely applicable and complimentary to existing steric and charge stabilization techniques. It may also be relevant for smaller scale biological interactions.

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[3] V. Tohver, J. E. Smay, A. Braemdagger, P. V. Braun, and J. A. Lewis, Proc. Natl. Acad. Sci. U.S.A. 98, 8950 (2001)