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Unsteady sedimentation of flocculating non-Brownian suspensions ALEXANDER ZINCHENKO, Uiniversity of Colorado, Boulder — Microstructural evolution and temporal dynamics of the sedimentation rate $U(t)$ are studied for a monodisperse suspension of non-Brownian spherical particles subject to van der Waals attraction and electrostatic repulsion in the realistic range of colloidal parameters (Hamaker constant, surface potential, double layer thickness etc.). A novel economical high-order multipole algorithm is used to fully resolve hydrodynamical interactions in the dynamical simulations with up to 500 spheres in a periodic box and $O(10^6)$ time steps, combined with geometry perturbation (Zinchenko A.Z. Phil. Trans. R. Soc. Lond. A (1998), vol. 356, 2953-2998) to incorporate lubrication and extend the solution to arbitrarily small particle separations. The total colloidal force near the secondary minimum often greatly exceeds the effective gravity/buoyancy force, resulting in the formation of strong but flexible bonds and large clusters as the suspension evolves from an initial well-mixed state of non-aggregated spheres. Ensemble averaging over many initial configurations is used to predict $U(t)$ for particle volume fractions between 0.1 and 0.25. The results are fully convergent, system-size independent and cover a 2-2.5 fold growth of $U(t)$ after a latency time.

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