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Eulerian flow modeling of suspensions containing interacting nano-particles: application to colloidal film drying. I. GERGIANAKIS, M. MEIRELES, P. BACCHIN, Y. HALLEZ, University of Toulouse - LGC — Nano-particles in suspension often experience strong non-hydrodynamic interactions (NHIs) such as electrostatic repulsions. In this work, we present and justify a flow modeling strategy adapted to such systems. Earlier works on colloidal transport in simple flows, were based on the solution of a transport equation for the colloidal volume fraction with a known fluid velocity field and a volume-fraction-dependent diffusion coefficient accounting for mass fluxes due to NHIs. Extension of this modelling to complex flows requires the coupled resolution of a momentum transport equation for the suspension velocity field. We use the framework of the Suspension Balance Model to show that in the $Pe \ll 1$ regime relevant here, the average *suspension* velocity field is *independent of NHIs between nanoparticles*, while the average *fluid phase* and *solid phase* velocity fields both always depend of the NHIs. Lastly, we apply this modelling strategy to the problem of the drying of a colloidal suspension in a micro-evaporator [Merlin et al. 2012, Soft Matter]. The influence of the effective Peclet number on the 1D/2D character of the flow is evaluated and the possible colloidal film patterning due to defaults of substrate topography is commented.

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