DFD17-2017-003175

Abstract for an Invited Paper
for the DFD17 Meeting of
the American Physical Society

Francois Frenkiel Award Talk: Drying dynamics of confined drops of charged colloidal dispersion

JEAN-BAPTISTE SALMON, LOF, UMR 5258 Solvay, CNRS, Universite de Bordeaux

We investigated the drying dynamics of a charged colloidal dispersion drop in a confined geometry, using Raman spectroscopy to measure spatially-resolved colloids concentration profiles. These measurements lead to estimates of the collective diffusion coefficient of the dispersion over a wide range of concentration. This coefficient is one order of magnitude higher than the Stokes-Einstein estimate showing the importance of the electrostatic interactions for the relaxation of concentration gradients. At the same time, we also performed fluorescence imaging of tracers during the drying of the drop, which reveals two distinct regimes. At early stages, concentration gradients along the drop lead to buoyancy-induced flows. Strikingly, these flows do not influence the concentration gradients that generate them, as mass transport remains dominated by diffusion. At longer time scales, tracers reveal the formation of a gel which dries quasi homogeneously. For such a gel, we show using linear poro-elastic modeling, that the drying dynamics is still described by similar transport equations as for the liquid dispersion, but the collective diffusion coefficient follows a modified generalized Stokes-Einstein relation, as demonstrated in the context of unidirectional consolidation.