Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Capillary Soring of Particles by Dip Coating BRIAN DINCAU, University of California Santa Barbara, MARTIN BAZANT, Massachusetts Institute of Technology, EMILIE DRESSAIRE, ALBAN SAURET, University of California Santa Barbara — High-throughput sorting or filtration of suspensions is a critical step in many industrial, geophysical, and biomedical processes. Here, we present a new scalable size-based separation technique which utilizes a dip coating meniscus as a tunable filter. When a plate is withdrawn from a liquid bath, a thin layer of liquid coats its surface. Below a given film thickness on the plate, the meniscus generates a strong capillary force at the stagnation point and prevents large particles from being entrained in the liquid film. We leverage the capillary filtration effect induced by the meniscus to sort particles by size. Indeed, the size threshold depends on the withdraw speed and fluid properties, so smaller particles are entrained while larger particles remain in the bath. We demonstrate this technique with bidisperse suspensions and explain how it could be applied to polydisperse suspensions or extended to biological suspensions. We rationalize our results in terms of dimensionless numbers (capillary and Bond numbers) and estimate the range of capillary number to separate particles of given sizes. This technique is well-suited for high-throughput operation due to the demonstrated scalability of industrial dip coating, combined with the clog-free nature of this meniscus-based filter.

Brian Dincau
University of California Santa Barbara

Date submitted: 30 Jul 2019 Electronic form version 1.4