Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Diffusiophoresis in Multivalent Electrolytes[1] JESSICA L. WILSON, SUIN SHIM, ANKUR GUPTA, HOWARD A. STONE, Princeton University — Diffusiophoresis is the spontaneous movement of colloidal particles in a concentration gradient of ions. As a small-scale phenomenon that harnesses energy from concentration gradients, diffusiophoresis may prove useful for passively manipulating particles in lab-on-a-chip type applications. Though naturally occurring ions are often multivalent, experimental studies on diffusiophoresis have been mostly limited to monovalent electrolytes. In this work, we investigate the motion of negatively charged polystyrene particles in one-dimensional salt gradients for a variety of multivalent electrolytes. Our results indicate that the valence combination of cation and anions significantly impacts the diffusiophoretic mobility of the particles. In addition, the ion valence also modifies the ambipolar diffusivity, which in turn influences the motion of the particles by changing the timescale at which the concentration gradients evolve. We also develop a 1D model and obtain a good agreement between our experimental and modeling results. Our results are applicable to systems where the chemical concentration gradient is made up of multivalent ions, and motivate future research to manipulate particles by exploiting ion valence.

[1]NSF CBET - 1702693

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Date submitted: 31 Jul 2019 Electronic form version 1.4