Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Thick Double Layers: From Energy Storage to Diffusiophoresis ANKUR GUPTA, Princeton University, PAWEL ZUK, Institute of Fundamental Technological Research, Polish Academy of Sciences, SUIN SHIM, HOWARD STONE, Princeton University — We study two distinct out-of-equilibrium processes relating to thick double layers: (a) charging dynamics of electrical double layers in a nanopore, and (b) diffusiophoretic mobility of colloidal particles in a time-dependent concentration field.

The charging dynamics of electrical double layers inside a cylindrical pore has been widely studied for the thin double layer limit. However, a model for the thick double layer limit is not readily available. Here, we demonstrate that the charging dynamics in the limit of thick double layers can be represented through an effective circuit model, much like the thin double layer limit. However, the physical meaning of the effective circuit elements, i.e., resistors and capacitors, is different between the two limits.

Diffusiophoresis refers to the movement of colloidal particles in a concentration gradient of an electrolyte. It is typically assumed that the diffusiophoretic mobility does not vary with electrolyte concentration. Here, we show that the diffusiophoretic mobility is coupled with electrolyte concentration, especially in a time-dependent concentration field where the regions of thick double layer may be more prevalent. We demonstrate that the diffusiophoretic mobility possesses a maximum with electrolyte concentration.

Ankur Gupta
Princeton University

Date submitted: 09 Aug 2020 Electronic form version 1.4