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Modeling of electrochemical flow capacitors using Stokesian dynamics MEHDI KARZAR JEDDI, HAOXIANG LUO, PETER CUMMINGS, KELSEY HATZELL, Vanderbilt University — Electrochemical flow capacitors (EFCs) are supercapacitors designed to store electrical energy in the form of electrical double layer (EDL) near the surface of porous carbon particles. During its operation, a slurry of activated carbon beads and smaller carbon black particles is pumped between two flat and parallel electrodes. In the charging phase, ions in the electrolyte diffuse to the EDL, and electrical charges percolate through the dynamic network of particles from the flat electrodes; during the discharging phase, the process is reversed with the ions released to the bulk fluid and electrical charges percolating back through the network. In these processes, the relative motion and contact of particle of different sizes affect not only the rheology of the slurry but also charge transfer of the percolation network. In this study, we use Stoekesian dynamics simulation to investigate the role of hydrodynamic interactions of packed carbon particles in the charging/discharging behaviors of EFCs. We derived mobility functions for polydisperse spheres near a no-slip wall. A code is implemented and validated, and a simple charging model has been incorporated to represent charge transfer. Theoretical formulation and results demonstration will be presented in this talk.

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