

Abstract Submitted
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Molecular views of surface driven transport : electro-osmosis, diffusio-osmosis, and beyond LYDERIC BOCQUET, CHRISTOPHE YBERT, University Lyon I , ARMAND AJDARI, ESPCI, Paris — We investigate the molecular mechanisms associated with surface driven transport, such as electro-, diffusio- or thermo-osmosis, which generate flows by application of a macroscopic gradient (of electric potential, solute concentration or temperature). The driving force (e.g., electric or osmotic) is located typically within a nanometric distance to the surface and the resulting effects are thus expected to be strongly affected by modifications of surface properties. We show in this context that moderate departures from the no-slip hydrodynamic boundary condition can result in very large enhancement of most interfacially driven transport, - up to two orders of magnitude for hydrodynamic slip lengths in the nanometer range ! -. The amplification of the effect due to slippage scales as the ratio between the slip length and the interfacial characteristic length (debye length, or solute attraction or depletion range). These predictions are confirmed qualitatively and quantitatively by molecular dynamics simulation of electro- and diffusio -osmosis. We will discuss the pertinence of these effects for flow enhancement in nano- or micro- fluidic geometries, but also for transport of macromolecules in externally applied or self- generated gradient, in line with recent experiments.

Lyderic Bocquet
University Lyon I

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