Tunable-Slip Boundaries and Electrokinetic Effects in Microchannels

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Abstract

Partial-slip boundary conditions determine the flow profile in the micrometer scale of modern separation devices where experimental evidence is found that the famous macroscopic no-slip boundary conditions are no longer applicable. In this talk I present a new approach to implement partial-slip boundary conditions in Dissipative Particle Dynamics (DPD). A viscous layer is introduced in the vicinity of the boundaries. Crucial parameter for the boundary conditions are the slip length and the position of the hydrodynamic boundaries. The presented method allows to tune the slip length systematically and an equation for the slip length and the hydrodynamic boundary positions as a function of the model parameters can be derived. Comparison with simulations show that this expression is valid from full-slip to no-slip. The simulation results for the counterion-induced Electroosmotic Flow are presented which serves as a special testcase for our approach. The numerical and the analytical results are compared to each other. In the last section I show some new numerical results about electrohydrodynamic screening in polylectrolytes.