Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Controlling turbulent drag across electrolytes using electric fields

ALPHA LEE, RODOLFO OSTILLA-MNICO, Harvard University — Controlling friction is a crucial problem in engineering science. Using direct numerical simulation, we investigate the phenomenology of turbulent Couette flows in electrolytes sheared by charged surfaces. We show how the presence of large shear rates affects the structure, dynamics and stress generation in the electrical double layer. The constant injection of energy from the sheared boundaries drives the double layer far from thermodynamic equilibrium, thus placing conventional statistical physical intuitions on a more tenuous footing. Critically, we uncover regimes where friction associated with turbulent dissipation could be controlled by applying an electric field. The implications of our results on chaotic electrokinetic flows and the non-equilibrium electrical double layer in other electrokinetic settings will also be discussed.

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Date submitted: 30 Jul 2016 Electronic form version 1.4