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Microfluidic experiments demonstrating induced-charge electro-osmosis JEREMY LEVITAN[1,3], YUXING BEN[2,3], TODD THORSEN[1,3], MARTIN BAZANT[2,3], [1] Department of Mechanical Engineering, MIT [2] Department of Mathematics, MIT [3] Institute for Soldier Nanotechnologies — Motivated by recent work on AC electro-osmosis, a general theory of "induced-charge electro-osmosis" (ICEO) has been developed, and a variety of ICEO-based pumping and mixing strategies for micro-fluidics have been proposed, using both DC and AC applied voltages. As in the electrophoresis of metal colloids (studied in the Russian literature), ICEO slip of a liquid electrolyte occurs at polarizable (metal or dielectric) surfaces in response to applied electric fields. Due to the nonlinear coupling of the applied field and its nonuniform and time-dependent induced surface charge, the ICEO slip velocity depends on the field amplitude squared, and thus it provides electrohydrodynamic rectification of AC forcing, especially in asymmetric geometries.Although many theoretical predictions have been made, here we provide clear experimental demonstrations of steady ICEO flows near metal structures in polymer microchannels. We investigate the effect of AC frequency, applied voltage, and geometry, and find reasonable agreement with theoretical predictions, allowing for Stern-layer capacitance.

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