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Geometric Modulation of Electro-Osmosis of the Second Kind in Micro-Nanochannel Interface Devices GILAD YOSSIFON, NETA LEIBOWITZ, YOAV GREEN, JARROD SCHIFFBAUER, SINWOOK PARK, Technion - Israel Institute of Technology — The charge-selective ionic transport through the nanochannel induces a concentration polarization effect. At sufficiently high currents, the depleted region develops an extended space charge layer adjacent to the micro-nanochannel interface. As the applied voltage exceeds a critical threshold, the loss of mechanical stability in this space-charge region leads to the formation of fast fluid vortices which undergo a complex wavelength-selection process. Both microchannel dimensions and interfacial geometry have been shown to affect the onset and subsequent development of the vortex flow field. Here we present results concerning suppression and control of the onset of instability as well as demonstrating competition between different vortex mechanisms. These effects modulate the interfacial mass transport and, hence, ionic current, through the interface and produce observable patterns. These results are of both fundamental and practical interest, with implications regarding early transitions from limiting to over-limiting currents and colloid-hydrodynamic interactions. The practical applications of such effects range from bio-molecular concentration, separation, and detection to micro-purification and on-chip electro-dialysis.

Gilad Yossifon
Technion - Israel Institute of Technology

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