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Inertial and Washburn Regimes in Filling of Charged Capillaries
SIDDHARTHA DAS, SUSHANTA K. MITRA, Department of Mechanical Engineering, University of Alberta, Edmonton, Alberta, Canada T6G 2G8, J.C.T. EIJKEL, BIOS, The Lab-on-a-Chip Group, MESA+ Institute for Nanotechnology, University of Twente, P.O. Box 217, 7500 AE Enschede, The Netherlands, N.R. TAS, Transducers Science and Technology, MESA+ Institute for Nanotechnology, University of Twente, P.O. Box 217, 7500 AE Enschede, The Netherlands, SUMAN CHAKRABORTY, Department of Mechanical Engineering, Indian Institute of Technology, Kharagpur-721302 — We discuss the filling dynamics of charged capillaries. Presence of charge on the capillary walls leads to formation of an Electric Double Layer (EDL) at the liquid-capillary-wall interface. Migration of the charge density of the EDL during capillary filling leads to two distinct effects - on one hand it reduces the capillary drive by triggering an opposing electrical force, while on the other hand the induced electroosmotic transport causes a reduction in the net drag force. The ultimate result is a capillary filling process with reduced filling speed, with altered inertial and Washburn regimes, as well as the criteria that dictates the transition between these two regimes.

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