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Shear Driven-Streaming Potential Flow in a Charged Slit Microchannel BEHNAM KHORSHIDI, SUBIR BHATTACHARJEE, Department of Mechanical Engineering, University of Alberta, Edmonton, Alberta T6G 2G8, Canada — The flow behavior in microfluidic devices is of great importance due to the need of precise control of the mass and momentum transport in these small scale channels. In the case of two-phase flow, e.g. the stratified flow of an oil layer above an aqueous phase, the situation becomes more interesting, but complicated. In most cases, the interface between the liquids is electrically charged due to the presence of the dissolved ions or colloidal particles. Therefore, there is a possibility that the physicochemical properties of the interface affect the flow behavior. The objective of the present study is to develop a fundamental understanding of flowing oil-water interface, with particular focus on the role of electrical forces acting at this layer. Analytical expressions are derived to describe the electrokinetic effects of electric double layer (EDL) on the shear-driven flow of an aqueous electrolyte solution between a moving and a stationary wall, the moving wall representing the charged oil-water interface. The flow field is obtained under a wide range of operating conditions. The results show that the velocity profile changes significantly depending on the surface potential of the moving wall, which reveals the importance of convective transport of ions near the mobile interface.

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