# Electroosmotic Flow of Viscoplastic Fluids Through a Slit Microchannel

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**Abstract:** In absence of external applied pressure, the hydrodynamically fully-developed electroosmotic flow (EOF) of non-Newtonian fluids in a slit microchannel is analytically studied. The Casson, Bingham and Herschel-Bulkley models are adopted to describe the non-Newtonian fluids. These non-Newtonian fluid models, known as viscoplastic models, are characterized by the existence of a yield stress. A flow domain needs to be divided into regions where the stress is smaller or larger in magnitude than the yield stress: known as the unsheared region with a plug flow, and the sheared region, respectively. With the rapid development of Micro-Electro-Mechanical Systems (MEMS) fabrication technology, many micro devices are often used involving viscoplastic materials, such as slurries, pastes, bloods, and suspensions etc. The flow of these viscoplastic materials in microchannels, however, has received less attention than they deserve. The present study aims to study EOF of these yield-stress materials. Analytical and numerical solutions are developed for the velocity profile under the condition of a uniform zeta potential of arbitrary values on the channel walls. The objective is to investigate the effect of yield stress on the velocity distribution, by comparing the plug flow velocity of these viscoplastic models with their counterparts with zero yield stress. The results show that no matter which model is employed, the plug flow always dominates the flow domain. Also, the plug flow velocity can be decreased to a different degree by the yield stress, depending on the viscoplastic materials.

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