

Analysis of Electroosmotic Flow of Power-law Fluids in a Microchannel(1D)

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Abstract

Electroosmotic flow of power-law fluids in a slit channel(1D) is analyzed. The governing equations are the Poisson-Boltzmann equation, the Cauchy momentum equation, Generalized Smoluchowski equation and the continuity equation are used to get shear stress, dynamic viscosity, and velocity distribution. Simulations are performed to examine the effects of κH , flow behavior index, double layer thickness and applied electric field on the shear stress, dynamic viscosity, velocity distribution, and average velocity flow rate of the electro-osmotic flow of power-law fluids.

Keywords: Microfluidics, Electroosmotic flow, Non-Newtonian power-law fluids, Generalized Smoluchowski equation, Fluid behavior index

Reference

Cunlu Zhaoa, Emilijk Zholkovskijb, Jacob H. Masliyahc, Chun Yanga, Analysis of electroosmotic flow of power-law fluids in a slit microchannel, *Journal of Colloid and Interface Science*, Volume 326, Issue 2, Pages 503–510, 15 October 2008.

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Figures used in the abstract

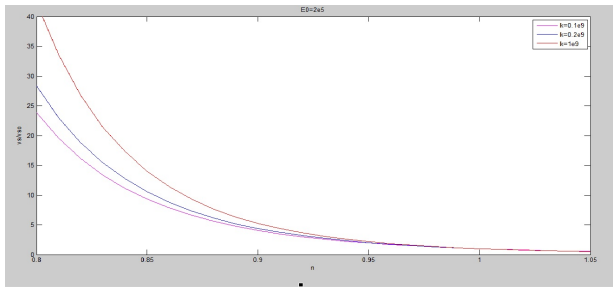


Figure 1: This plot shows the ratio of generalized Smoluchowski velocity to the conventional Smoluchowski velocity versus the flow behaviour index 'n'.

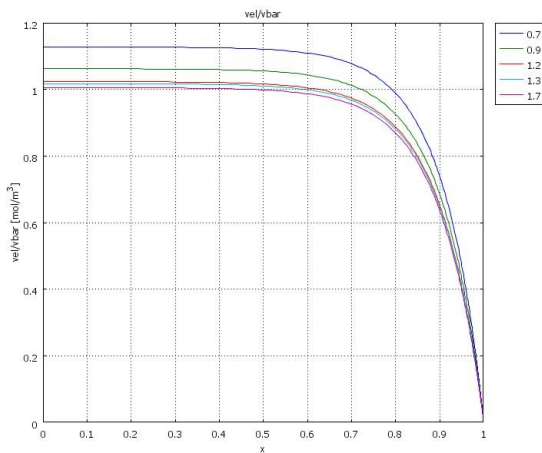


Figure 2: This plot depicts the velocity distributions normalized by the average velocity for various values of the fluid behaviour index, n while keeping $K(\kappa)$ constant.

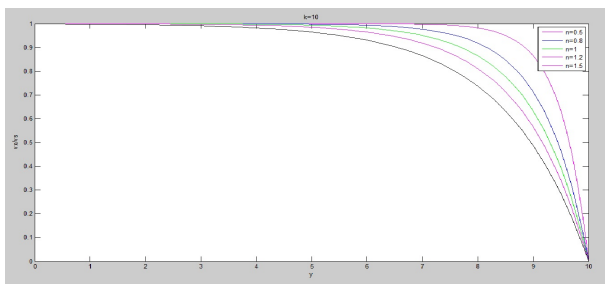


Figure 3: This plot shows the ratio of velocity to the Smoluchowski velocity versus the flow behaviour index n .

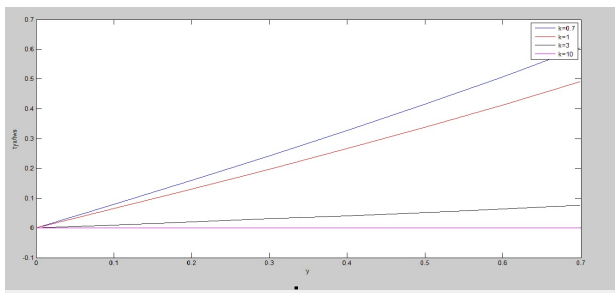


Figure 4: Normalized Shear Stress distributions (τ/τ_{ws}) for various values of K.