**Enhancing Micromixing and Vortex Formation During Electroosmotic Flow in V-shaped Microchannels With Varying Zeta-Potential**

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**Abstract**

Amplifying micromixing performance has become a primary focus in developing microfluidic devices. In this work, we investigate the efficacy of electroosmotic flow in V-shaped homogeneous and heterogeneous microchannels with varying zeta-potential surfaces on the walls to enhance mixing efficiency. A computational fluid dynamics model is developed to achieve enhanced mixing efficiency to solve the relevant equations governing the fluid flow, electric field, and zeta-potential on the walls, along with the relevant boundary conditions. The velocity and the surface averaged vorticity in various cases are reported, and the optimum combination for generating maximum mixing efficiency is determined. The results reveal that the number of vortices in the microchannel can be augmented by increasing the number of heterogeneous surfaces. Moreover, the size of the vortices can be regulated by regulating the length of the heterogeneous surface. The angle of the ‘V-shape’ can also be varied to regulate micromixing. Higher intensity vortices are reported as the angle of the V-shape’ is increased. The findings of this study may facilitate the optimization of mixing efficiency by enhancing the intensity of vortices in microfluidic devices utilizing V-shaped microchannels for their operation.

**Keywords**: Micromixing, Vortex, Electroosmosis, Zeta-Potential