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Experimental and Theoretical Characterization of an AC Electroosmotic Micromixer

Naoki SASAKI[1)], Takehiko KITAMORI[1)] and Haeng-Boo KIM[1)]

1) Department of Applied Chemistry, Graduate School of Engineering, The University of Tokyo

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We have reported on a novel microfluidic mixer based on AC electroosmosis. To elucidate the mixer characteristics, we performed detailed measurements of mixing under various experimental conditions including applied voltage, frequency and solution viscosity. The results are discussed through comparison with results obtained from a theoretical model of AC electroosmosis. As predicted from the theoretical model, we found that a larger voltage (~20 $V_{p\text{-}p}$) led to more rapid mixing, while the dependence of the mixing on frequency (1 − 5 kHz) was insignificant under the present experimental conditions. Furthermore, the dependence of the mixing on viscosity was successfully explained by the theoretical model, and the applicability of the mixer in viscous solution (2.83 mPa s) was confirmed experimentally. By using these results, it is possible to estimate the mixing performance under given conditions. These estimations can provide guidelines for using the mixer in microfluidic chemical analysis.

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