

Mixing enhancement by using electrokinetic instability in a Microchannel

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Experimental studies have been performed to apply electrokinetic instability as a means of fluid mixing. A time-periodic electric field is introduced to excite the instability in a cross channel. It is generated by the sum of a static field and an alternating field. The characteristics of instability have been considered with the frequency of applied electric field as a key parameter. Through the frequency sweeping from 0.1 Hz to 50 Hz, it has been found that the instability is most enhanced when the frequency of the applied electric field is close to the half of the frequency of instability in the form of a sinusoidal wave generated under the static electric field. The fact may be explained based on the concept of hydrodynamic resonance. The degree of mixing is evaluated quantitatively by analyzing the distribution of fluorescence dye and it is confirmed that there exists an optimal frequency for enhancement of fluid mixing. The existence of the optimal frequency is expected to provide a valuable guideline for the design of an efficient micro-mixer.