

ELECTROHYDRODYNAMIC MIXING IN MICRO-CHANNELS

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The stability of a two-fluid flow in a channel is of great importance in the design of various microfluidic devices [1]. In this work, such an instability is triggered to enhance mixing within a micro-channel by means of the application of an electric field perpendicular to the liquid-liquid interface between the two fluids. Experiments are conducted using the flow of two liquids with different electrical properties. Mixing is observed between the two layers, with a strong interfacial instability. The latter is also studied analytically using linear stability theory in the case where the fluids are assumed to be leaky dielectrics. We make no assumption on the magnitude of the ratio of fluid to electric time scales, and thus solve the full conservation equation for the interfacial charge. Conditions under which the electric field is destabilizing are determined, and the influence of the various parameters of the problem on the interface stability is thoroughly analyzed.

References

[1] S.L. Anna, N. Bontoux and H.A. Stone, "Formation of dispersions using flow focusing in microchannels," *Applied Physics Letters*, 82(3):364–366, 2003.

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