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Experimental and numerical determination of flow mixing enhancement in electrokinetics cross shaped microchannel flows due to spatially periodic wall perturbations AMADOR GUZMAN, MARIO DICAPUA, DAMING CHEN, FRANCISCO MONTERO, MARIA CANALES, Pontificia Universidad Catolica de Chile, LABONACHIP TEAM — Liquid flows in microchannels usually occur at very low Reynolds numbers (<1) because inertial forces are strongly dumped by the very small microchannel characteristic length and the dominant viscous forces. When an electrical field is applied to the microchannel ends, a time-dependent stable flow arises at a very low Reynolds number because another non dimensional parameter, the Rayleigh number, takes a dominant role. When the Rayleigh numbers surpasses a threshold value, a unstable behavior sets in convecting the flow instabilities backward and forward and consequently leading to an increase of the flow mixing that is particularly important when liquids with different electrical conductivities need to be mixed, particularly in physiological flows. One way of achieving this type of behavior but to a lower critical Rayleigh number is by adding spatially periodic inhomogeneities to the channel walls. In this research, we investigate the flow mixing enhancement occurring in a cross-shaped microchannels when liquids with different electrical conductivities get in the microchannel at different inlets and flows downstream due to the application of an electrical field and get together in the outlet branch of the microchannel, which contain spatially periodic wall inhomogeneities. Experiments and numerical simulations are carried out to determine and evaluate stable and unstable behaviors and evaluate the flow mixing enhancement.

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