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Computational and experimental investigation of capillary self-focusing in a microfluidic system S. AFKHAMI, New Jersey Institute of Technology, M. HEIN, R. SEEMANN, Saarland University, L. KONDIC, New Jersey Institute of Technology — We present a capillary focusing method for generating monodisperse submicrometric droplets. The emulsification technique relies on an abrupt change in the aspect ratio of a single shallow and wide microchannel that merges into a deep reservoir [Appl. Phys. Lett. 88:024106 (2006)]. We present a computational framework, supported by experimental observation, to address the capillary self-focusing, in which the interface between the two fluids takes the shape of a tongue narrowing in the flow direction just ahead of the holding reservoir. Our numerical approach is based on a volume-of-fluid method for computing the interface motion and for modeling the surface tension in a Hele-Shaw flow. We present and compare numerical and experimental results for the width of the tongue and predict and measure the transition between two different emusification mechanisms occuring in this geometry.

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