

Abstract Submitted  
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**Theory of microfluidic step-emulsification** ALEXANDER LESHANSKY, Technion - Israel Institute of Technology, ZHENZHEN LI, SAMUEL METAIS, ESPCI Paris-Tech, LEN PISMEN, Technion - Israel Institute of Technology, PATRICK TABELING, ESPCI Paris-Tech — We present a comprehensive study of the microfluidic step-emulsification process for high-throughput production of monodisperse colloidal droplets. The “microfluidic step emulsifier” combines a shallow microchannel operating with two co-flowing immiscible fluids and an abrupt (step-like) opening to a deep and wide reservoir. Based on Hele-Shaw hydrodynamics, we determine the quasi-static shape of the fluid interface prior to transition to oscillatory step-emulsification at low capillary numbers. The transition threshold obtained from scaling arguments yields an excellent agreement with experimental data. A closed-form expression for the size of the droplets generated in the step-emulsification regime and derived using geometric arguments also shows a very good agreement with the experiment.

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