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Numerical simulation of droplet formation regimes and sizes in microfluidic T-junction devices MEHDI NEKOUEI, SIVA VANAPALLI, Texas Tech University, Department of Chemical Engineering — The T-junction geometry has been widely used for producing monodisperse droplets in microfluidic devices. Droplet formation regimes and sizes are expected to depend on a variety of conditions including flow rates, capillary number, channel geometry and viscosity ratio. Experiments have investigated drop production at a T-junction in a narrow control parameter space and developed analytical models for specific operating regimes. In this study, we take advantage of numerical simulations based on volume-of-fluid method to explore this broad parameter space systematically, and contrast our results with prior experimental data. We find our simulations predict well the regimes of squeezing, dripping and jetting. We also observe that our drop size data is in good agreement with three different experimental reports. Although our results match experimental data, the analytical models do not agree with each other since they are based on specific operating conditions. We use numerical simulations to elucidate the missing components in the physics of drop formation at a T-junction, with an attempt to reconcile existing analytical models.

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