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A Numerical Study on Drop Formation in Flow-Focusing Microfluidic Devices JING LOU, BAILI ZHANG, JINSONG HUA, Institute of High Performance Computing — Generation of mono-dispersed droplets in microfluidic devices using "flow-focusing" arrangement has received intensive interest due to its geometrical simpleness and easiness in controlling the droplet size by adjusting the flow rate of continuous phase. Experiments have shown that there are two kinds of droplet generation modes, namely dripping mode and jetting mode, the droplet sizes formed in these two modes varies sharply when the mode transition occurs. CFD based multiphase-flow simulation is applied to investigate drop formation pattern in the flow focusing micro channel in this study. The focus is on the effect of the flow focusing channel geometry, especially the expansion angle from the nozzle to collection tube, on the droplet size and the formation modes. It is found that channel geometry has significant effect on the droplet size and formation mode. Reducing expansion angle leads to the decrease of droplet size and hence the increase of drop formation frequency. The most interesting finding is that when the flow rate of the continuous phase increases, the transition point from dripping mode to jetting mode is also shifted as a result of reducing expansion angle. The simulation results will help us not only to understand the mechanism of droplet, but also to improve the flow focusing channel design to produce monodisperse droplets with minor effects from droplet generation mode transition.

Baili Zhang
Institute of High Performance Computing

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