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A Numerical Analysis of Droplet Breakup in Asymmetric T-Junctions with Different Outlet Pressure Gradients.[1] WAY LEE CHENG, Texas AM University at Qatar, ARUM HAN, Texas AM University, REZA SADR, Texas AM University at Qatar — Droplet splitting is the breakup of a parent droplet into two or more daughter droplets of desired sizes. It is done to improve production efficiency and investigational capacity in microfluidic devices. Passive splitting is the breakup of droplets into precise volume ratios at predetermined locations without external power sources. In this study, a 3-D simulation was conducted using the Volume-of-Fluid method to analysis the breakup process of a droplet in asymmetric T-junctions with different outlet arm lengths. The arrangement allows a droplet to be split into two smaller droplets of different sizes, where the volumetric ratio of the daughter droplets depends on the length ratios of the outlet arms. The study identified different breakup regimes such as primary, transition, bubble and non-breakup under different flow conditions and channel configurations. Furthermore, a close analysis to the primary breakup regimes were done to determine the breakup mechanisms at various flow conditions. The analysis show that the breakup mechanisms in asymmetric T-junctions is different than a regular split. A pseudo-phenomenological model for the breakup criteria was presented at the end. The model was an expanded version to a theoretically derived model for the symmetric droplet breakup.

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