

Secondary Breakup of Water Droplets by Pneumatic Valves in Multi-layer Microfluidic Chips

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Microfluidic systems became to useful platforms in many research areas including chemistry, material science and pharmaceuticals because of their easy fabrication and precise controllability. Especially, emulsion droplets in microfluidics are taking a growing interest as chemical reactors or confining geometries of self-assembly. However, to control the size of droplets in common microfluidic chips, flow rates of two fluids must be changed or microfluidic chips which have different geometrical dimensions must be needed.

In this study, we fabricated the multi-layer microfluidic chips with pneumatic valves for secondary breakup of water droplets by the valves without changing the flow rate or the microfluidic chip. As controlling the pressure applied to the control channel, geometrical dimensions of the flow channel become narrow by pneumatic valves. So, while droplets go through the region having the membrane, they break up because of their unstable state. So, we examined control of sizes of secondary droplets by various pressure applied to control channel in the multi-layer microfluidic chips.