

Valve-Mediated Breakup of Droplets at T-Shaped Channel in Microfluidic Chip

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Droplet-based microfluidic systems have been used for controlling chemical reactions and transporting chemical or biological materials. For qualitative analysis, the control of the droplet size is extremely important. However, droplet generation methods using T-junction or flow focusing geometry can generate droplets with monodisperse size distribution. Therefore, for the parallel analysis or reaction, additional droplet-generation geometries are indispensable and each injected fluid has to be controlled separately.

In this study, we demonstrated valve-mediated breakup of droplets actively in a T-shaped channel for a microfluidic platform of parallel analysis or reaction system. Since geometrically modified channel by a pressure-actuated valve influenced flow velocity of flow channel, the uniform emulsion droplets, produced by shearing at a T-junction, were broken up at the T-shaped channel with different sizes. By changing the applied pressure to the valves, the droplet size could be controlled precisely. Also, by changing the applied pressure value gradually, the size of the droplets broken up at T-shaped channel could be controlled gradually.