Generation of liquid metal double emulsion droplet using gravity-induced microfluidics

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Electronic Supplementary Information (ESI)

1. Different configuration of liquid metal double emulsion droplet

The process of generating liquid metal double emulsion droplets with stable double sphere-type configuration is shown in **ESI† Movie 1.**

The process of generating liquid metal double emulsion droplets with push-type configuration is shown in **ESI† Movie 2.**

The process of generating liquid metal double emulsion droplets with pull-type configuration is shown in **ESI† Movie 3.**

2. The type of "unable to generate"

When double emulsion droplets are unable to be generated, the phenomena are shown in **Fig. S1.**

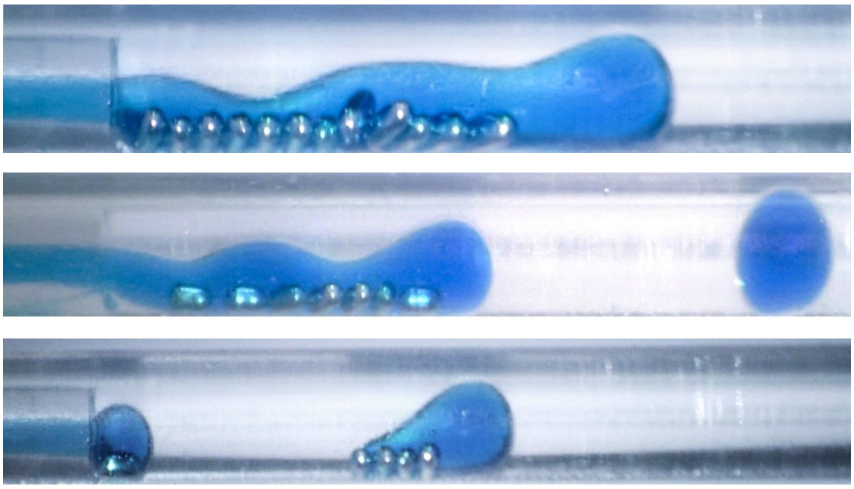

Fig. S1. Images of the "unable to generate" type

The gravity drives Galinstan downward on the wall of the horizontal tube. The deposited inner droplets prevent the formation of shell droplets, leading to the parallel flow of the middle phase. At lower flow rate of the outer phase, the middle phase is unable to be sheared off by the outer phase into droplets. At higher flow rate, the shell droplets are separated from the inner droplets by a stronger drag force from the outer phase after forming. It is experimentally observed that the middle phase continues to move forward under the drag force of the outer phase, while the Galinstan droplet is deposited on the channel wall by gravity.

3. Fitting parameters in equations (4) and (5)

Table S1. Fitting parameters in equations (4) and (5)

(a). Fitting parameters in equation (4) $t = t_a \cdot \ln\left[c\left(\frac{1}{\mathrm{Ca}}\right)^{b} \cdot \left(\frac{1}{\mathrm{Re}_2}\right)^{1.07} \right]$

Q_2 (ml/min)	t_a (s)	b	c	R^2
0.01	7.450	0.704	$e^{-9.037}$	0.8431
0.02	5.649	0.896	$e^{-9.755}$	0.9356
0.03	4.674	0.775	$e^{-8.722}$	0.9728
0.04	4.332	0.711	$e^{-8.262}$	0.9742
0.05	4.104	0.805	$e^{-8.573}$	0.9408

(b). Fitting parameters in equation (5) $t = -t_b \cdot (\mathrm{m}\sin\theta - 1)$

Ca	t_b (s)	m	R^2
0.022	3.54	0.20	0.9659
0.028	3.07	0.48	0.9786