

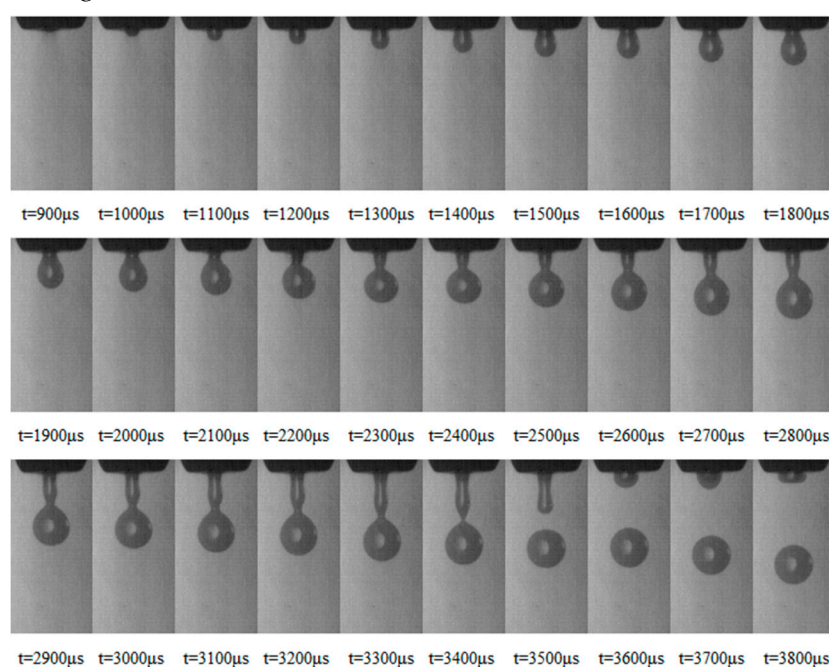
Supplementary Materials: In Situ Image Acquisition and Measurement of Microdroplets Based on Delay Triggering

Xuefeng Chang, Kang Zheng, Dan Xie *, Xiayun Shu *, Keyu Xu, Wenhuan Chen, Bo Li and Changjian Wu

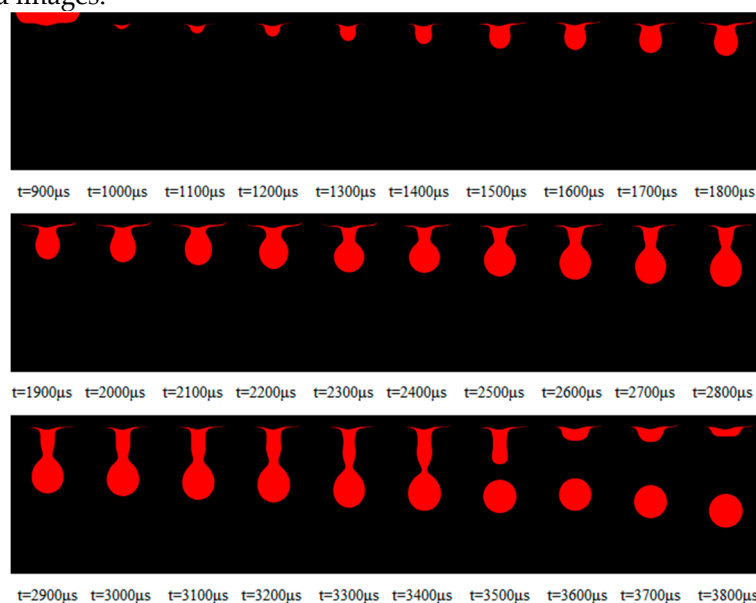
The supplementary material consists of five sets of time-series diagrams (original images) of droplet formation and flight process based on the time-delay acquisition system and the final processing renderings, and a line chart of droplet coordinates and velocity as a function of time.

Set 1:

(1) Original images:



(2) Processed images:



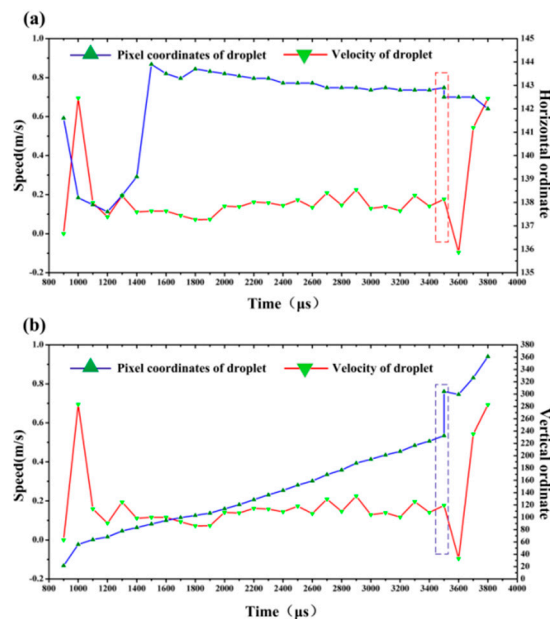
(3) Center of gravity coordinates of liquid (drop) at different times (unit: pixel)

Time	900 μ s	1000 μ s	1100 μ s	1200 μ s	1300 μ s
Coordinate	(141.6,21.5)	(138.2,56.0)	(137.9,63.9)	(137.6,68.2)	(138.3,77.9)
Time	1400 μ s	1500 μ s	1600 μ s	1700 μ s	1800 μ s
Coordinate	(139.1,83.4)	(143.9,89.2)	(143.5,94.9)	(143.3,99.6)	(143.7,103.1)
Time	1900 μ s	2000 μ s	2100 μ s	2200 μ s	2300 μ s
Coordinate	(143.6,106.8)	(143.5,113.8)	(143.4,120.6)	(143.3,128.7)	(143.3,136.5)
Time	2400 μ s	2500 μ s	2600 μ s	2700 μ s	2800 μ s
Coordinate	(143.1,143.7)	(143.1,152.3)	(143.1,159.0)	(142.9,169.4)	(142.9,176.7)
Time	2900 μ s	3000 μ s	3100 μ s	3200 μ s	3300 μ s
Coordinate	(142.9,187.9)	(142.8,194.3)	(142.9,201.2)	(142.8,207.0)	(142.8,216.7)
Time	3400 μ s	3500 μ s	3500 μ s	3600 μ s	3700 μ s
Coordinate	(142.8,223.7)	(142.9,232.5)	(142.5,304.3)	(142.5,299.5)	(142.5,326.5)
Time	3800 μ s				
Coordinate	(142.0,361.0)				

(4) Velocity of liquid (drop) at different times (unit: m/s):

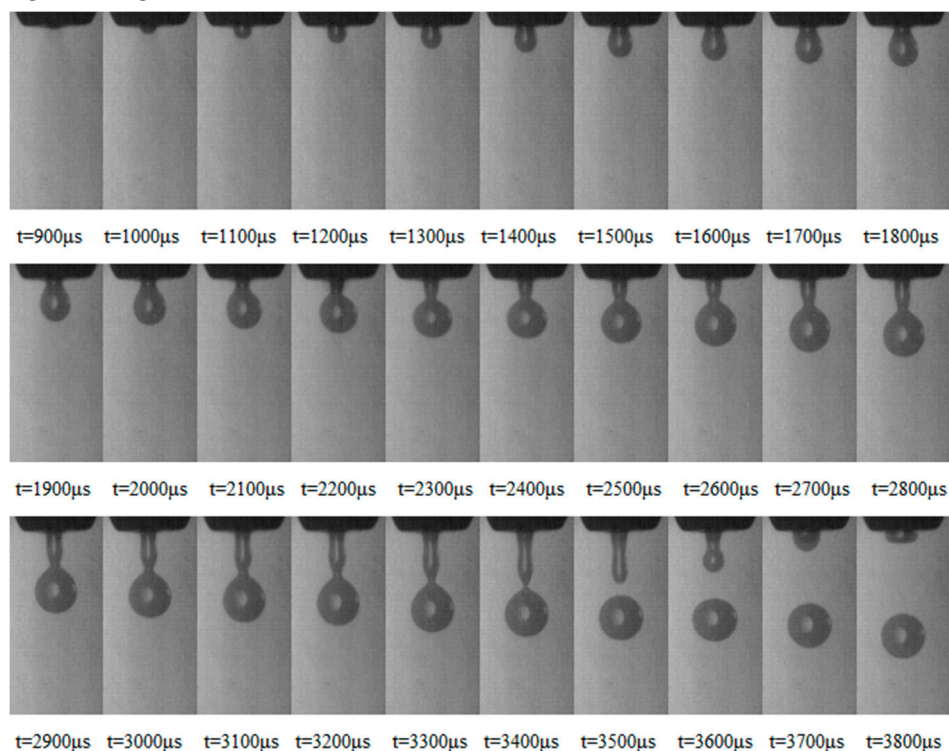
Time	900 μ s	1000 μ s	1100 μ s	1200 μ s	1300 μ s	1400 μ s
Speed(m/s)	0	0.695	0.159	0.086	0.194	0.111
Time	1500 μ s	1600 μ s	1700 μ s	1800 μ s	1900 μ s	2000 μ s
Speed(m/s)	0.116	0.116	0.093	0.072	0.073	0.141
Time	2100 μ s	2200 μ s	2300 μ s	2400 μ s	2500 μ s	2600 μ s
Speed(m/s)	0.138	0.162	0.158	0.144	0.173	0.135
Time	2700 μ s	2800 μ s	2900 μ s	3000 μ s	3100 μ s	3200 μ s
Speed(m/s)	0.209	0.146	0.225	0.219	0.139	0.117
Time	3300 μ s	3400 μ s	3500 μ s	3600 μ s	3700 μ s	3800 μ s
Speed(m/s)	0.141	0.177	0.177	-0.096	0.543	0.693

(5) Coordinate-time and speed-time line chart:

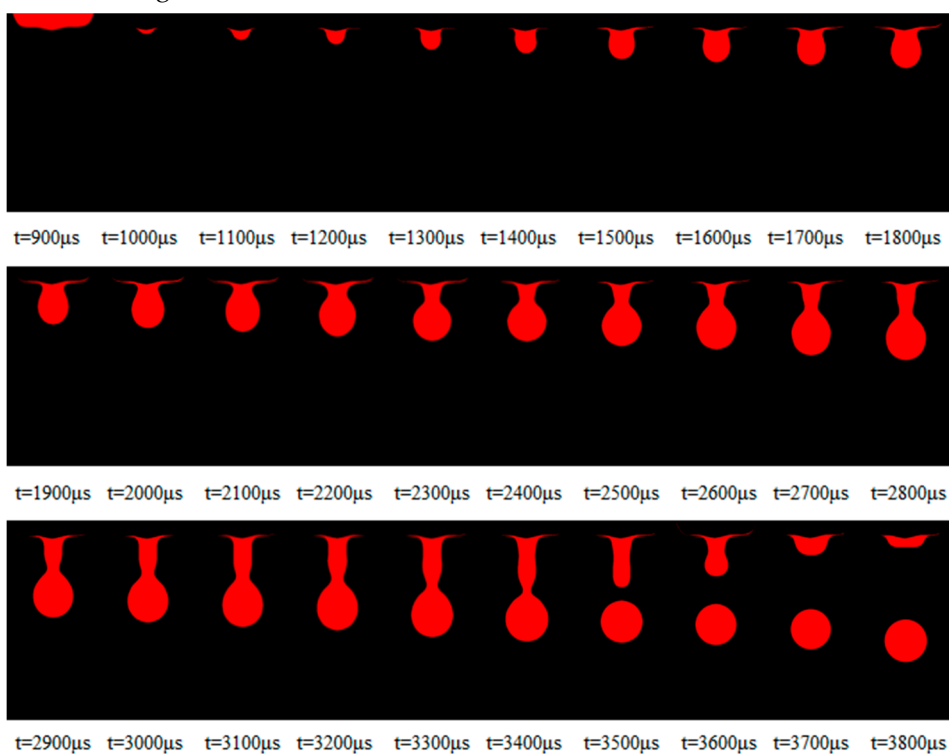


Set 2:

(1) Original images:



(2) Processed images:



(3) Center of gravity coordinates of liquid (drop) at different times (unit: pixel)

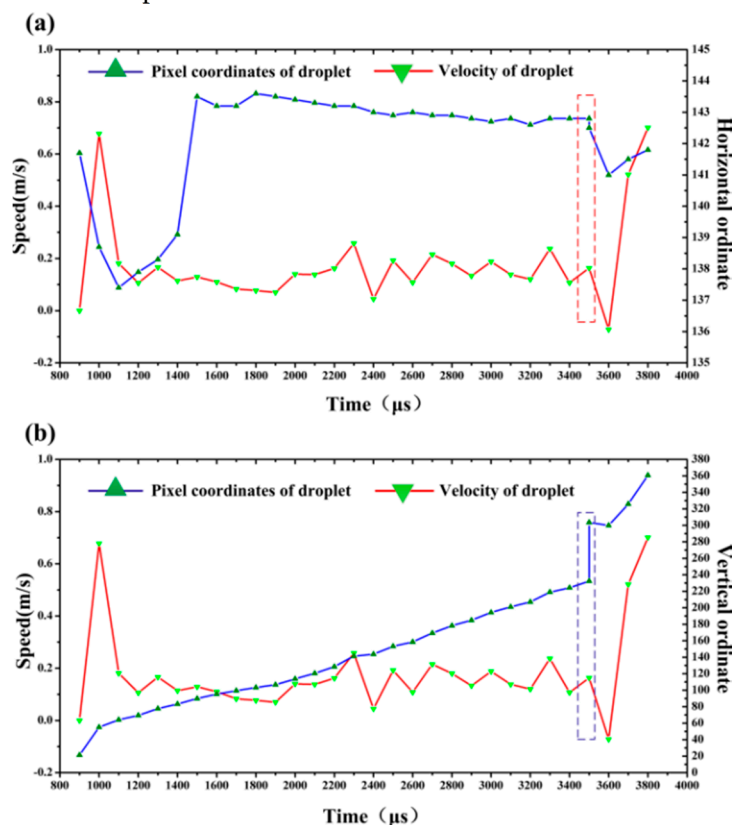
Time	900 μ s	1000 μ s	1100 μ s	1200 μ s	1300 μ s
Coordinate	(141.7,21.4)	(138.7,55.2)	(137.4,64.2)	(137.9,69.4)	(138.3,77.7)
Time	1400 μ s	1500 μ s	1600 μ s	1700 μ s	1800 μ s

Coordinate	(139.1,83.3)	(143.5,89.8)	(143.2,95.3)	(143.2,99.4)	(143.6,103.2)
Time	1900 μ s	2000 μ s	2100 μ s	2200 μ s	2300 μ s
Coordinate	(143.5,106.7)	(143.4,113.7)	(143.3,120.5)	(143.2,128.6)	(143.2,141.4)
Time	2400 μ s	2500 μ s	2600 μ s	2700 μ s	2800 μ s
Coordinate	(143.0,143.7)	(142.9,153.2)	(143.0,158.6)	(142.9,169.3)	(142.9,178.3)
Time	2900 μ s	3000 μ s	3100 μ s	3200 μ s	3300 μ s
Coordinate	(142.8,184.9)	(142.7,194.3)	(142.8,201.1)	(142.6,207.1)	(142.8,218.9)
Time	3400 μ s	3500 μ s	3500 μ s	3600 μ s	3700 μ s
Coordinate	(142.8,224.2)	(142.8,232.3)	(142.5,303.5)	(141.0,299.9)	(141.5,325.8)
Time	3800 μ s				
Coordinate	(141.8,360.7)				

(4) Velocity of liquid (drop) at different times (unit: m/s):

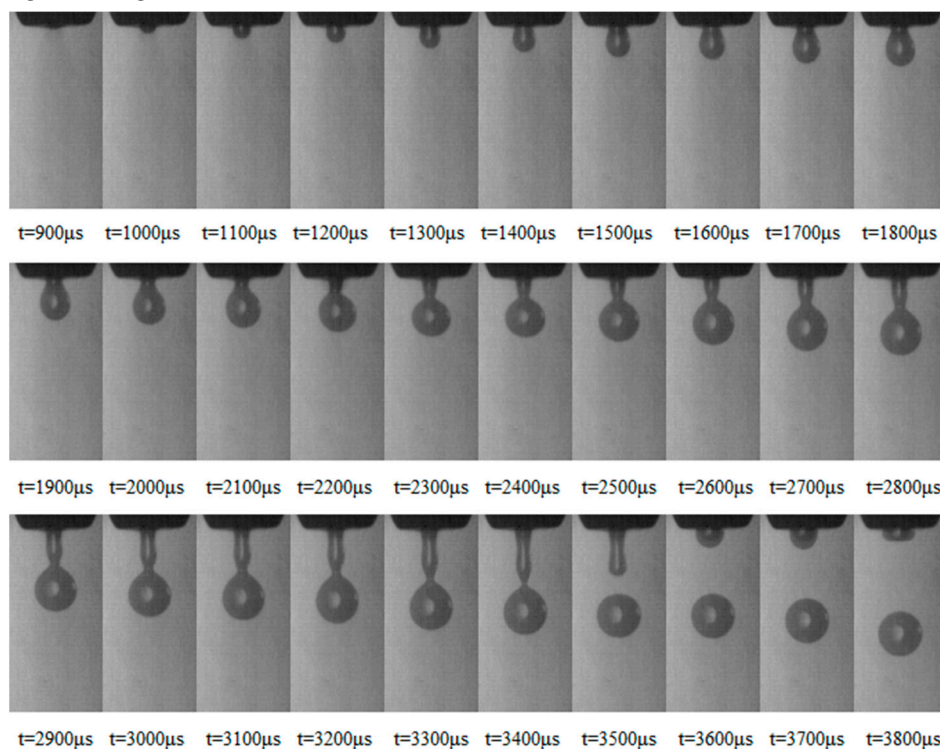
Time	900 μ s	1000 μ s	1100 μ s	1200 μ s	1300 μ s	1400 μ s
Speed(m/s)	0	0.678	0.181	0.106	0.166	0.114
Time	1500 μ s	1600 μ s	1700 μ s	1800 μ s	1900 μ s	2000 μ s
Speed(m/s)	0.129	0.110	0.083	0.077	0.070	0.140
Time	2100 μ s	2200 μ s	2300 μ s	2400 μ s	2500 μ s	2600 μ s
Speed(m/s)	0.138	0.162	0.258	0.045	0.192	0.108
Time	2700 μ s	2800 μ s	2900 μ s	3000 μ s	3100 μ s	3200 μ s
Speed(m/s)	0.215	0.180	0.133	0.188	0.138	0.120
Time	3300 μ s	3400 μ s	3500 μ s	3600 μ s	3700 μ s	3800 μ s
Speed(m/s)	0.107	0.163	0.163	-0.072	0.521	0.701

(5) Coordinate-time and speed-time line chart:

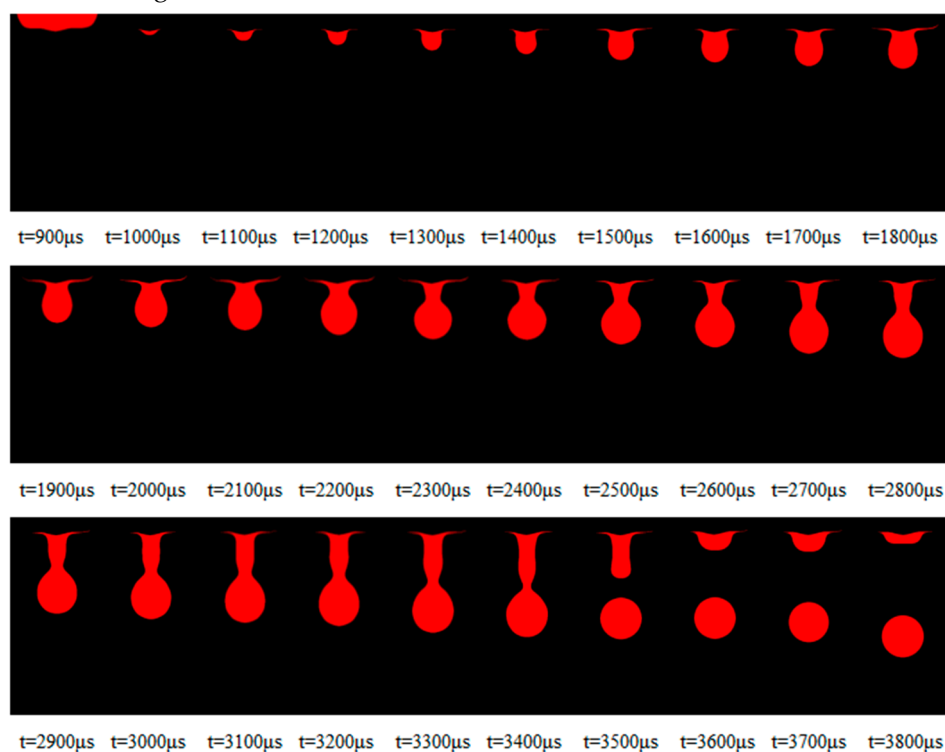


Set 3:

(1) Original images:



(2) Processed images:



(3) Center of gravity coordinates of liquid (drop) at different times (unit: pixel)

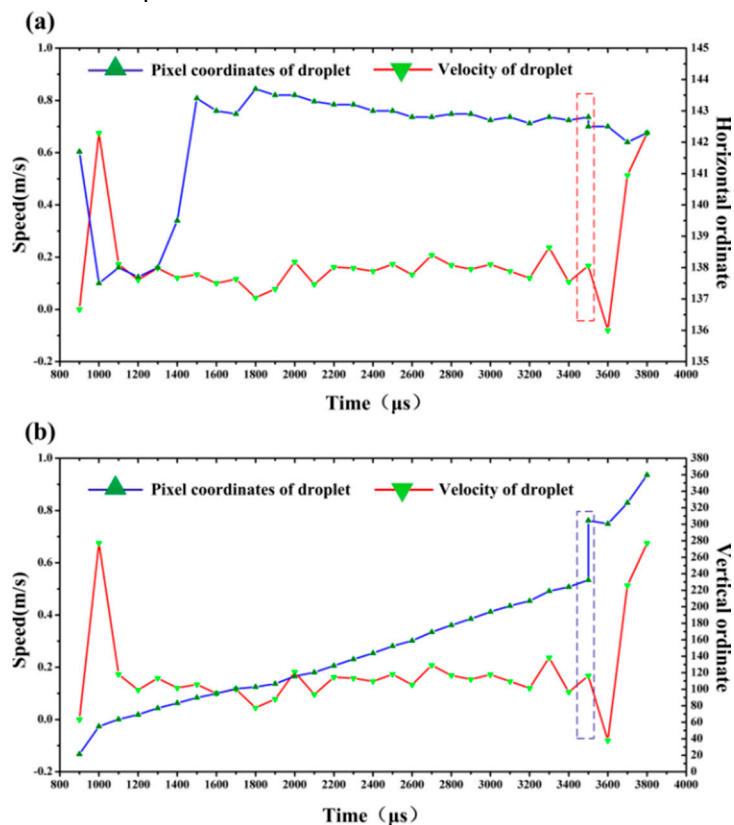
Time	900 μ s	1000 μ s	1100 μ s	1200 μ s	1300 μ s
Coordinate	(141.7,21.4)	(137.5,55.0)	(138.0,63.6)	(137.7,69.3)	(138.0,77.1)
Time	1400 μ s	1500 μ s	1600 μ s	1700 μ s	1800 μ s

Coordinate	(139.5,83.2)	(143.4,89.8)	(143.0,94.8)	(142.9,100.6)	(143.7,102.8)
Time	1900 μ s	2000 μ s	2100 μ s	2200 μ s	2300 μ s
Coordinate	(143.5,106.7)	(143.5,115.8)	(143.3,120.5)	(143.2,128.6)	(143.2,136.4)
Time	2400 μ s	2500 μ s	2600 μ s	2700 μ s	2800 μ s
Coordinate	(143.0,143.7)	(143.0,152.3)	(142.8,158.9)	(142.8,169.2)	(142.9,177.6)
Time	2900 μ s	3000 μ s	3100 μ s	3200 μ s	3300 μ s
Coordinate	(142.9,185.3)	(142.7,193.9)	(142.8,201.1)	(142.6,207.1)	(142.8,218.9)
Time	3400 μ s	3500 μ s	3500 μ s	3600 μ s	3700 μ s
Coordinate	(142.7,224.1)	(142.8,232.4)	(142.5,304.5)	(142.5,300.5)	(142.0,326.0)
Time	3800 μ s				
Coordinate	(142.3,359.6)				

(4) Velocity of liquid (drop) at different times (unit: m/s):

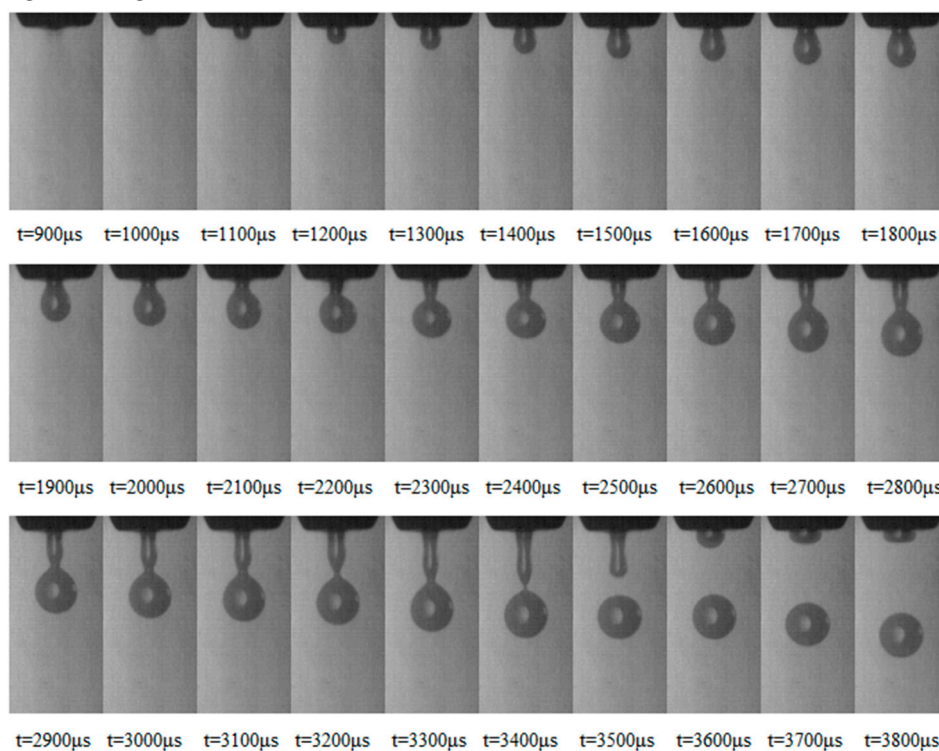
Time	900 μ s	1000 μ s	1100 μ s	1200 μ s	1300 μ s	1400 μ s
Speed(m/s)	0	0.675	0.173	0.113	0.158	0.121
Time	1500 μ s	1600 μ s	1700 μ s	1800 μ s	1900 μ s	2000 μ s
Speed(m/s)	0.134	0.100	0.116	0.045	0.078	0.182
Time	2100 μ s	2200 μ s	2300 μ s	2400 μ s	2500 μ s	2600 μ s
Speed(m/s)	0.096	0.162	0.158	0.146	0.173	0.133
Time	2700 μ s	2800 μ s	2900 μ s	3000 μ s	3100 μ s	3200 μ s
Speed(m/s)	0.208	0.169	0.154	0.172	0.146	0.120
Time	3300 μ s	3400 μ s	3500 μ s	3600 μ s	3700 μ s	3800 μ s
Speed(m/s)	0.105	0.167	0.167	-0.080	0.513	0.675

(5) Coordinate-time and speed-time line chart:

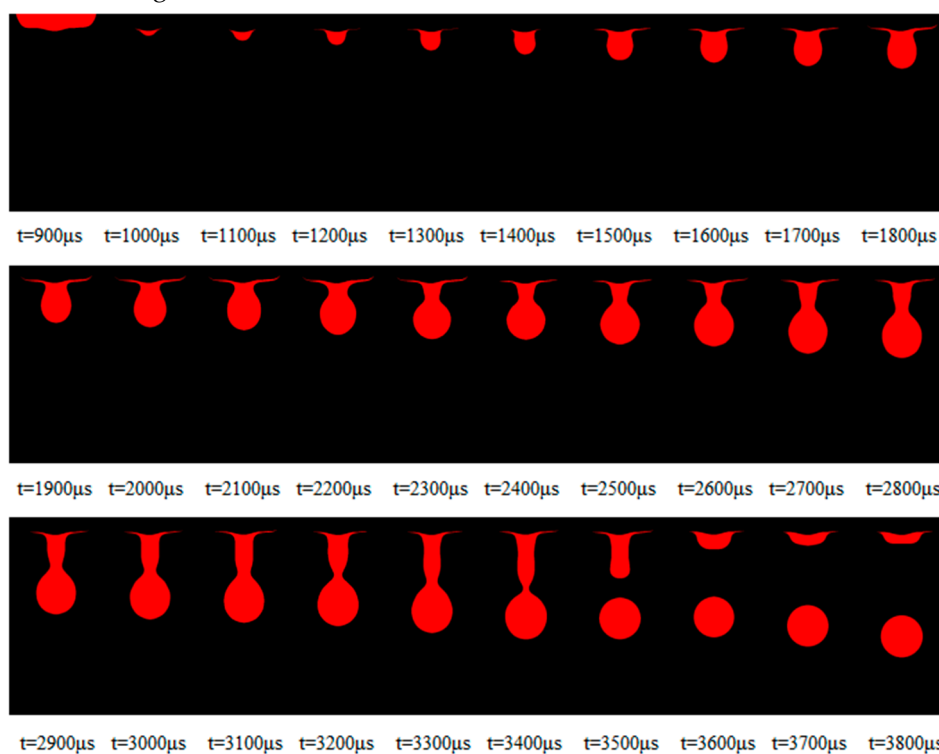


Set 4:

(1) Original images:



(2) Processed images:



(3) Center of gravity coordinates of liquid (drop) at different times (unit: pixel):

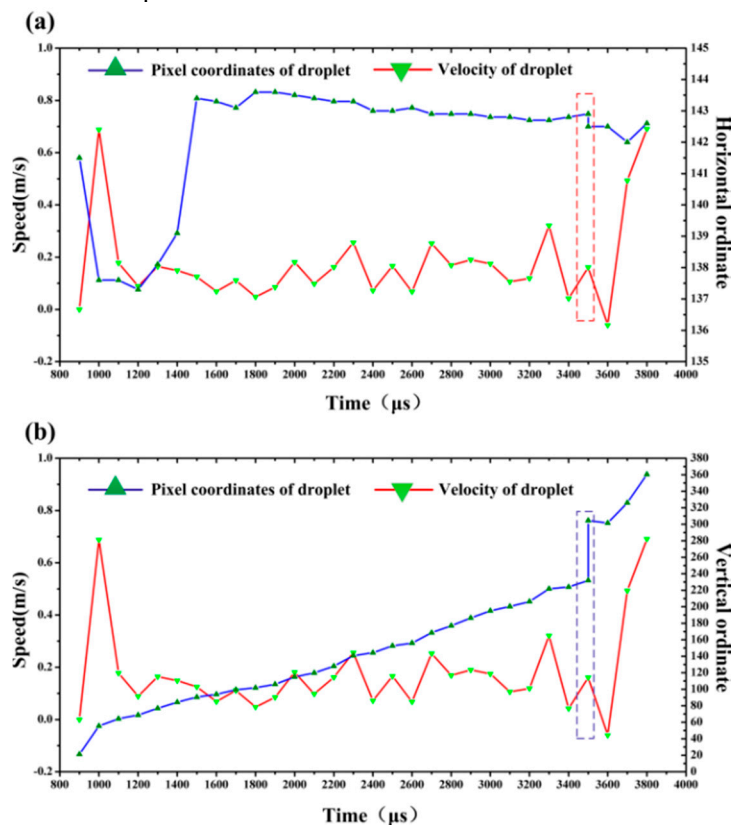
Time	900µs	1000µs	1100µs	1200µs	1300µs
Coordinate	(141.5,21.2)	(137.6,55.4)	(137.6,64.3)	(137.3,68.7)	(138.1,76.9)
Time	1400µs	1500µs	1600µs	1700µs	1800µs

Coordinate	(139.1,84.3)	(143.4,90.5)	(143.3,93.9)	(143.1,99.4)	(143.6,101.8)
Time	1900 μ s	2000 μ s	2100 μ s	2200 μ s	2300 μ s
Coordinate	(143.6,106.0)	(143.5,115.0)	(143.4,119.9)	(143.3,128.0)	(143.3,140.7)
Time	2400 μ s	2500 μ s	2600 μ s	2700 μ s	2800 μ s
Coordinate	(143.0,144.3)	(143.0,152.6)	(143.1,156.0)	(142.9,168.6)	(142.9,177.0)
Time	2900 μ s	3000 μ s	3100 μ s	3200 μ s	3300 μ s
Coordinate	(142.9,186.4)	(142.8,195.1)	(142.8,200.4)	(142.7,206.3)	(142.7,221.8)
Time	3400 μ s	3500 μ s	3500 μ s	3600 μ s	3700 μ s
Coordinate	(142.8,223.9)	(142.9,231.9)	(142.5,304.5)	(142.5,301.5)	(142.0,326.0)
Time	3800 μ s				
Coordinate	(142.6,360.4)				

(4) Velocity of liquid (drop) at different times (unit: m/s):

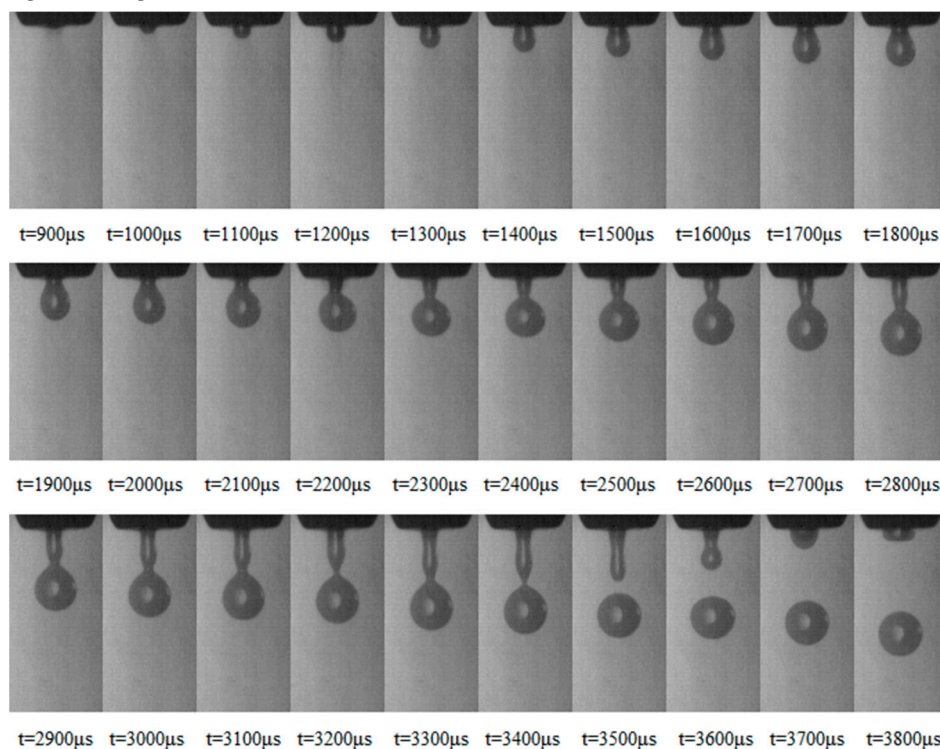
Time	900 μ s	1000 μ s	1100 μ s	1200 μ s	1300 μ s	1400 μ s
Speed(m/s)	0	0.688	0.178	0.089	0.164	0.149
Time	1500 μ s	1600 μ s	1700 μ s	1800 μ s	1900 μ s	2000 μ s
Speed(m/s)	0.125	0.069	0.111	0.048	0.085	0.181
Time	2100 μ s	2200 μ s	2300 μ s	2400 μ s	2500 μ s	2600 μ s
Speed(m/s)	0.098	0.162	0.256	0.072	0.166	0.068
Time	2700 μ s	2800 μ s	2900 μ s	3000 μ s	3100 μ s	3200 μ s
Speed(m/s)	0.253	0.169	0.190	0.175	0.106	0.119
Time	3300 μ s	3400 μ s	3500 μ s	3600 μ s	3700 μ s	3800 μ s
Speed(m/s)	0.042	0.161	0.161	-0.060	0.493	0.691

(5) Coordinate-time and speed-time line chart:

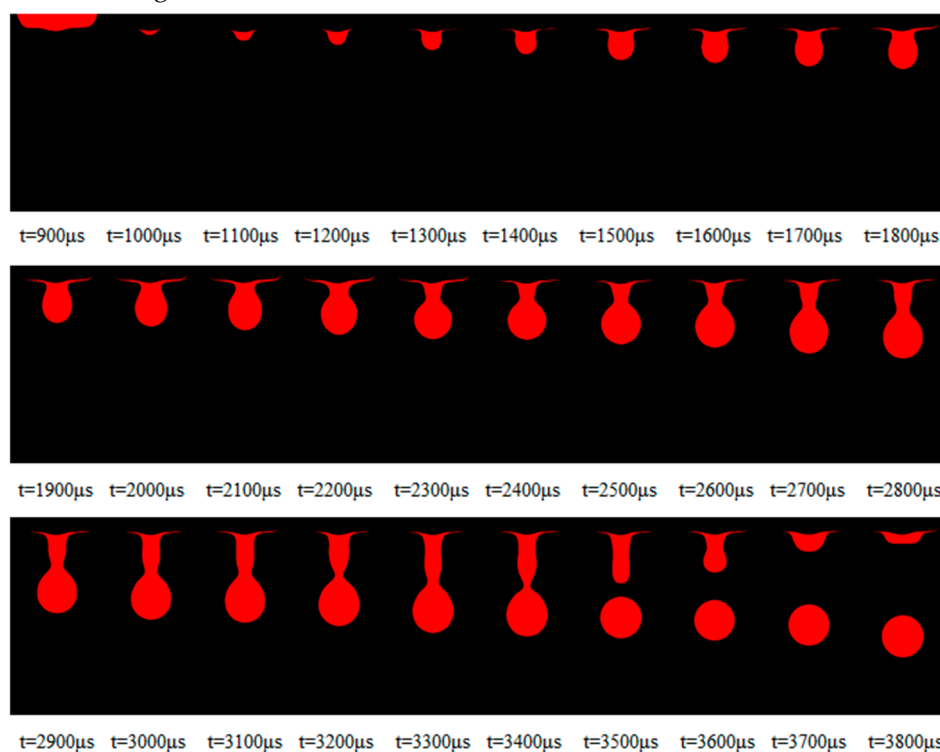


Set 5:

(1) Original images:



(2) Processed images:



(3) Center of gravity coordinates of liquid (drop) at different times (unit: pixel):

Time	900 μs	1000 μs	1100 μs	1200 μs	1300 μs
Coordinate	(141.5,21.2)	(137.9,55.0)	(137.7,64.6)	(138.0,69.2)	(137.6,76.6)
Time	1400 μs	1500 μs	1600 μs	1700 μs	1800 μs

Coordinate	(139.8,82.3)	(143.3,89.8)	(143.3,94.3)	(143.1,99.9)	(143.7,102.8)
Time	1900 μ s	2000 μ s	2100 μ s	2200 μ s	2300 μ s
Coordinate	(143.6,106.7)	(143.5,113.0)	(143.4,119.9)	(143.3,128.0)	(143.3,140.7)
Time	2400 μ s	2500 μ s	2600 μ s	2700 μ s	2800 μ s
Coordinate	(143.0,144.3)	(142.9,153.0)	(142.9,158.4)	(142.9,168.7)	(142.9,178.5)
Time	2900 μ s	3000 μ s	3100 μ s	3200 μ s	3300 μ s
Coordinate	(142.9,184.2)	(142.8,196.8)	(142.8,200.4)	(142.7,210.3)	(142.7,218.8)
Time	3400 μ s	3500 μ s	3500 μ s	3600 μ s	3700 μ s
Coordinate	(142.7,224.7)	(142.8,232.2)	(142.5,303.5)	(141.0,302.0)	(142.5,326.5)
Time	3800 μ s				
Coordinate	(142.0,360.5)				

(4) Velocity of liquid (drop) at different times (unit: m/s):

Time	900 μ s	1000 μ s	1100 μ s	1200 μ s	1300 μ s	1400 μ s
Speed(m/s)	0	0.679	0.193	0.093	0.148	0.115
Time	1500 μ s	1600 μ s	1700 μ s	1800 μ s	1900 μ s	2000 μ s
Speed(m/s)	0.149	0.091	0.112	0.059	0.078	0.127
Time	2100 μ s	2200 μ s	2300 μ s	2400 μ s	2500 μ s	2600 μ s
Speed(m/s)	0.138	0.162	0.256	0.072	0.174	0.109
Time	2700 μ s	2800 μ s	2900 μ s	3000 μ s	3100 μ s	3200 μ s
Speed(m/s)	0.207	0.197	0.114	0.253	0.072	0.199
Time	3300 μ s	3400 μ s	3500 μ s	3600 μ s	3700 μ s	3800 μ s
Speed(m/s)	0.108	0.161	0.161	-0.030	0.493	0.683

(5) Coordinate-time and speed-time line chart:

