Abstract Submitted
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Optofluidic droplet coalescence on a microfluidic chip[1] JIN HO JUNG, KYUNG HEON LEE, KANG SOO LEE, HYUNJUN CHO, BYUNG HANG HA, GHULAM DESTGEER, HYUNG JIN SUNG, KAIST — Coalescence is the procedure that two or more droplets fuse during contact to form a larger droplet. Optofluidic droplet coalescence on a microfluidic chip was demonstrated with theoretical and experimental approaches. Droplets were produced in a T-junction geometry and their velocities and sizes were adjusted by flow rate. In order to bring them in a direct contact of coalescence, optical gradient force was used to trap the droplets. A theoretical modeling of the coalescence was derived by combining the optical force and drag force on the droplet. The analytical expression of the optical force on a sphere droplet was employed to estimate the trapping efficiency in the ray optics regime. The drag force acting on the droplet was calculated in terms of the fluid velocity, viscosity and the geometrical parameters of a microfluidic channel. The droplet coalescence was conducted in a microfluidic setup equipped with a 1064 CW laser, focusing optics, a syringe pump, a custom-made stage and a sCMOS camera. The droplets were successfully coalesced using the optical gradient force. The experimental data of coalescence were in good agreement with the prediction.

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