TECHNOLOGY

On Demand First in First Out Droplet Generating Systems

OVERVIEW

Background
Microfluidics is a class of technology where the precise manipulation of fluids in very small channels and devices leads to improved devices in fields as different as medical diagnoses and inkjet printing. A subclass of microfluidic technology is Droplet-based Microfluidics where instead of manipulating a continuous flow, fluids are broken into discrete volumes (droplets) allowing diverse applications in chemical and biological analysis and processing such as the production of microcapsules and microparticles, digital PCR, protein crystallization, and single-cell analysis. Unfortunately, most droplet generating platforms are designed with complex architectures and operation mechanisms requiring ancillary equipment to achieve droplet discretization, metering, capture and coalescing. This becomes a hindrance for the commercialization of droplet-based microfluidic devices since it requires skilled operating technicians with little room to scale up.
Invention:
Researchers from the University of Maryland's Department of Mechanical Engineering have invented a novel droplet generation and manipulation platform for microfluidic devices that is simple to produce and easy to scale from single droplets to thousands of droplets. Featuring an array of individually addressable membrane displacement traps, this platform provides flexible and programmable control over droplet manipulation using a single actuator topology to perform all key droplet operations including discretization, release, transport, capture, metering, and merging. The platform is also designed to allow for bidirectional movement of droplets that will allow for arbitrary combinations of both serial processing steps. In a second droplet generating microfluidic system invented by the same research team, the droplets can be stored using a trap array coined as the, ' storage library' and then selectively transported to a merging unit using a device configuration that enables the trap array to operate in a first in first out manner.

Advantages:
· Single actuation mechanism for multiple functions
· Readily adapted for multiple analyses
· Cost efficient due to reduction of operating equipment

Applications:
· Nucleic Acid based assays
· Single cell analyses
· Drug Screening
· Microparticle production and manipulation
· Research tools

Research Articles: Lab Chip, 2017, 17, 3717-3724, Lab Chip, 2019, 19, 493

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Additional Information

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EXTERNAL RESOURCES

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