Microfluidic Platform to Control Particle Placement and Spacing in Channel Flow

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SUMMARY

UCLA researchers in the Department of Bioengineering have developed a microfluidic platform that controls particle spacing during solution exchange applications using inertial flow.

BACKGROUND

Micro-scale particles in flow can be found in many fields of science and technology. One example is cells in blood stream. Control of particle motion/position in flow has numerous applications such as flow cytometry and particle encapsulation. Control of particle positions in particle laden flows is typically achieved by external force fields such as acoustic, electric, or magnetic fields. However, such methods consume power, require a bulky setup and efficiencies degrade with increasing flow rate, thus lowering the throughput. Recently, fluid inertia has been used to manipulate particle position in flow with high throughput in the transverse direction (particle-wall spacing), but not the lateral direction (particle-particle spacing). Although studies to date have provided simple descriptions of lateral spacing phenomena as a function of particle Reynolds number, the mechanisms of self-assembly in these systems are not well understood and have not been engineered effectively.

INNOVATION

Researchers from the Department of Bioengineering at UCLA have developed a microfluidic platform that controls particle-wall and particle-particle interactions by intertial flow, which leads to capability of manipulation of inter-particle spacing during solution exchange. This microfluidic platform utilizes expansion and contraction channel geometries to make particle distribution more uniform in Reynolds number flow. Moreover, particle-particle spacing can be tuned to a desired frequency. Unlike existing particle manipulation methods, particle manipulation by inertial flow gives extremely high-throughput without bulky external control units. The device fabrication is simple and easy, requiring PDMS molding and bonding only.

APPLICATIONS

- Flow cytometry
- Cell printing
- Particle encapsulation
- Metamaterial synthesis

ADVANTAGES

- High throughput with capabilities up to 1 m/s flow speed
- Easy fabrication
- Compact, no need for external control units
- No limitations from material properties of particles

STATE OF DEVELOPMENT

Experiments and model simulations have been performed.

RELATED MATERIALS

▶ Dynamic self-assembly and control of microfluidic particle crystals. *PNAS.* (2010)

PATENT STATUS

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INVENTORS

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OTHER INFORMATION

KEYWORDS

Microfluidics, particle flow, hydrodynamic interaction, inertial ordering, flow cytometry

CATEGORIZED AS

▶ **Medical**

▶ Research Tools

RELATED CASES

2011-038-0

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	10,690,290	06/23/2020	2011-038

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Integrated Isolation, Emulsification, And Single-Cell Assay
- Monodisperse Emulsions Templated By 3D-Structured Microparticles
- Enhanced Fluorescence Readout And Reduced Inhibition For Nucleic Acid Amplification Tests
- Label-Free Digital Bright Field Analysis of DNA Amplification
- Robust, Ultra-Flexible, Micro-Encoded Ferromagnetic Tape for Bioseparation and Assembly
- Controllable Emulsification and Point-Of-Care Assays Driven by Magnetic Induced Movement of the Fluid

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