

## Ultra-scale parallelization of microfluidic generated particles using silicon and glass substrates

Chemically robust, integrated droplet generation for industrial-scale production

### Inventors

[David Issadore](#), Assistant Professor of Bioengineering and Electrical & Systems Engineering and [Daeyeon Lee](#), Professor of Chemical & Biomolecular Engineering

### STATE OF DEVELOPMENT

Proof-of-concept testing and prototype developed

### INTELLECTUAL PROPERTY

Provisional pending

### DESIRED PARTNERSHIP

License  
Co-development

### APPLICATIONS

- Diagnostics
- Drug or catalyst high-throughput screening
- Pharmaceutical production
- Synthetic biology and nucleic acid sequencing
- Cosmetics
- Emulsions
- Gas bubbles
- Lab-on-a-chip devices

### LEARN MORE

Sarah Johnson  
[johnsa@upenn.edu](mailto:johnsa@upenn.edu)  
215-746-7253

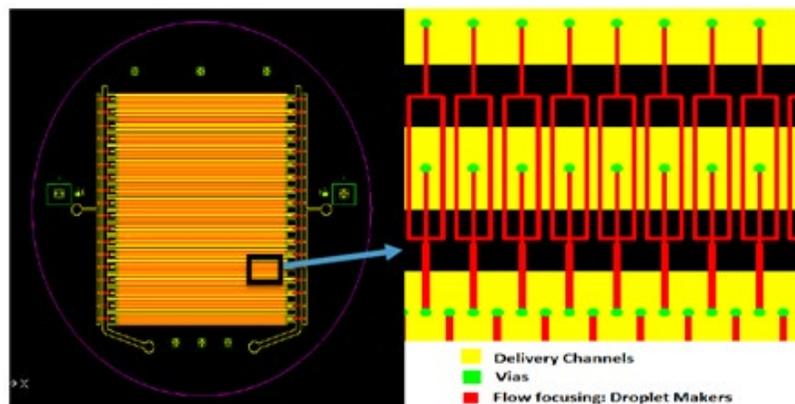
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### Technology

The Issadore and Lee labs have developed a new fabrication method for their droplet maker technology to attain ultra-high throughput. The fabrication of over 10,000 microfluidic droplet generators on one device has been accomplished, achieving droplet production rates of up to 100L/hour with uniform flow distribution. The chip fabrication is innovative over previous designs of microfluidic droplet generators that used PDMS. PDMS is incompatible with many solvents, high temperatures, and high pressures. Additionally, PDMS channels can deform, leading to cross-contamination between channels or solvent leakage, and can absorb small molecules, disadvantageous for drug screening applications. In this device, a silicon wafer was deep reactive ion etched to create microchannels, with one inlet for the continuous phase and one inlet for the dispersed phase. Each flow-focusing microfluidic generator is organized in a ladder geometry, with hydraulic resistance equivalent throughout the chip.

### Advantages

- Compatible with range of organic solvents
- Can withstand high temperatures (>200°C) and high pressures (>1000 psi)
- Stable, continuous operation for industrial-scale production
- Very high flow rates



**Image Caption:** On left, schematic outline of the design of 10,000 microfluidic droplet generators in a 4 inch silicon wafer. On right, schematic view of flow-focusing droplet generators.