

3D-glass molds for facile production of complex droplet microfluidic chips.

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[Details](#)



Abstract

In order to leverage the immense potential of droplet microfluidics, it is necessary to simplify the process of chip design and fabrication. While polydimethylsiloxane (PDMS) replica molding has greatly revolutionized the chip-production process, its dependence on 2D-limited photolithography has restricted the design possibilities, as well as further dissemination of microfluidics to non-specialized labs. To break free from these restrictions while keeping fabrication straightforward, we introduce an approach to produce complex multi-height (3D) droplet microfluidic glass molds and subsequent chip production by PDMS replica molding. The glass molds are fabricated with sub-micrometric resolution using femtosecond laser machining technology, which allows directly realizing designs with multiple levels or even continuously changing heights. The presented technique significantly expands the experimental capabilities of the droplet microfluidic chip. It allows direct fabrication of multilevel structures such as droplet traps for prolonged observation

and optical fiber integration for fluorescence detection. Furthermore, the fabrication of novel structures based on sloped channels (ramps) enables improved droplet reinjection and picoinjection or even a multi-parallelized drop generator based on gradients of confinement. The fabrication of these and other 3D-features is currently only available at such resolution by the presented strategy. Together with the simplicity of PDMS replica molding, this provides an accessible solution for both specialized and non-specialized labs to customize microfluidic experimentation and expand their possibilities.

Involved units

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Leibniz-HKI-Authors



[Details](#)



Martin Roth

[Details](#)



Oksana Shvydkiv

[Details](#)



Miguel Angel Tovar Ballen

[Details](#)



Thomas Weber

[Details](#)

Topics

[Droplet-based micro-fluidics](#)

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