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3D Printing for Fabrication of Microfluidic Devices

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Recent advance in additive manufacturing potentiated the fabrication of microchannels, albeit with limitations in resolution of printed structures, freedom of geometry, and choice of printable materials. We investigated two approaches using 3D printing for fabrication of microfluidic channels, and studied their characteristics, suitability and limitation. The first approach is sacrificial molding. We fabricated mechanically stable molds for 3D microchannels that can be completely removed in water. The process of fabrication is compatible with broad range of rigid and soft polymer matrices cured by heat or ultraviolet (UV) light. Importantly, the mold is stable and resilient in hydrogels despite being hygroscopic, which allows for fabrication of microchannels in biocompatible matrices. The second approach is direct fabrication of microfluidic molds by 3D printing. We evaluated four common techniques of 3D printing-fused deposition modelling (FDM), selective laser sintering (SLS), stereolithography (SL) and photo-polymer inkjet printing (PJ) for their suitability to fabricate molds for soft lithography. We also discuss the use of direct ink writing (DIW) 3D printers for fabrication of microfluidic devices.

Biography

Michinao Hashimoto is an assistant professor at Singapore University of Technology and Design leading Soft Fluidics Group. Centered around an overarching research theme of microfluidics, the group tackles on various cross-disciplinary themes in biomedical engineering, digital fabrication, and soft robotics. Michinao received his B.S. degrees in Chemistry and Biochemistry/Biophysics from Oregon State University (2003), and Ph.D. degree from Harvard University (2009), followed by postdoctoral training at MIT and Children's Hospital Boston.

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