**A9 (proceeding): Functional photopolymer resin formulations for additive manufacturing using micro-stereolithography**

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## Motivation

The fabrication of microfluidic devices with functional units, e.g., valves, pumps and micromixer, has been based on a combination of photo- and soft lithography, and proceeds via a multi-step approach for almost two decades. While additive manufacturing is increasingly becoming important in microfluidic device fabrication owing to its one-step processing – particularly micro-stereolithography (µSL) – the materials used for the fabrication of flow cells are typically brittle and inelastic (*E*-moduli: several MPa to GPa), not functional or do not allow for fabricating microscopic resolution below 100 µm, which is demanded for state-of-the-art microfluidics. The goal of this project is to develop photopolymer formulations, which can be used for the fabrication of functional and switchable microfluidic devices using high-resolution µSL.

## State of the art and preliminary work

Photopolymer resin formulations with a defined composition have already been utilized by the ThieleLab for additive manufacturing using commercial microstereolithography printers (e.g., ASIGA Pico2 HD, Lithoz Cerafab 7500) for the fabrication of microfluidic cells with microchannels exhibiting a lateral resolution of 75 µm. These were successfully used for the production of water/oil, oil/water as well as for water/oil/water and oil/water/oil emulsions. Owing to its multilayer channel geometry, the very same flow cell could be used for the production of any single or double emulsion. The produced droplets were then utilized as templates for microgel fabrication.

## Scientific goals

The objective is to develop a material library of photopolymer resin formulations for the fabrication of polymer building components – particularly microfluidic devices - via stereolithography. The main focus will be on establishing elastic materials suitable for the fabrication of air-pressure controlled valves (previous work was conducted in [2]), piezoelectric materials suitable for the fabrication of electrically controlled pumps as well as plasmonically heated materials involving switchable LCST polymer components. These formulations will be optimized regarding reaction kinetics, minimal voxel size, transparency, functionality and homogeneity (e.g., in case of nanoparticle fillers based on gold or barium titanate).

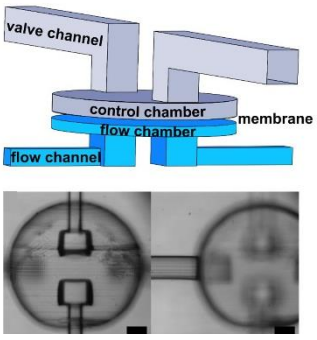


Figure 1: Example of a elastic vent fabricated by additive manufacturing utilizing tailored photopolymer resins.