Electronic Supplementary Information (ESI)

Direct 3D Printing of Cell-laden Constructs in Microfluidic Architectures

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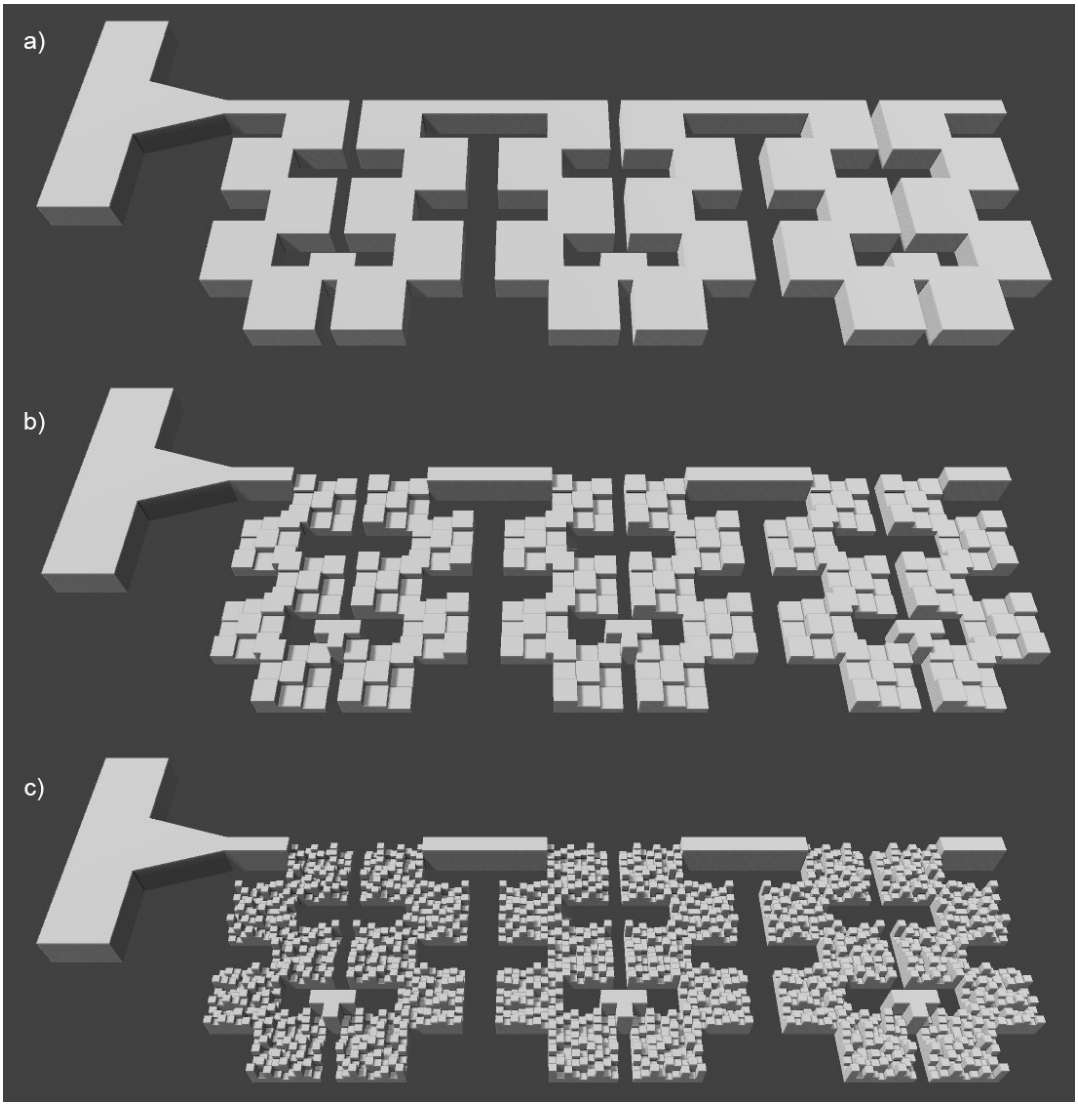
ESI Text

Scanning Electron Microscopy Preparation

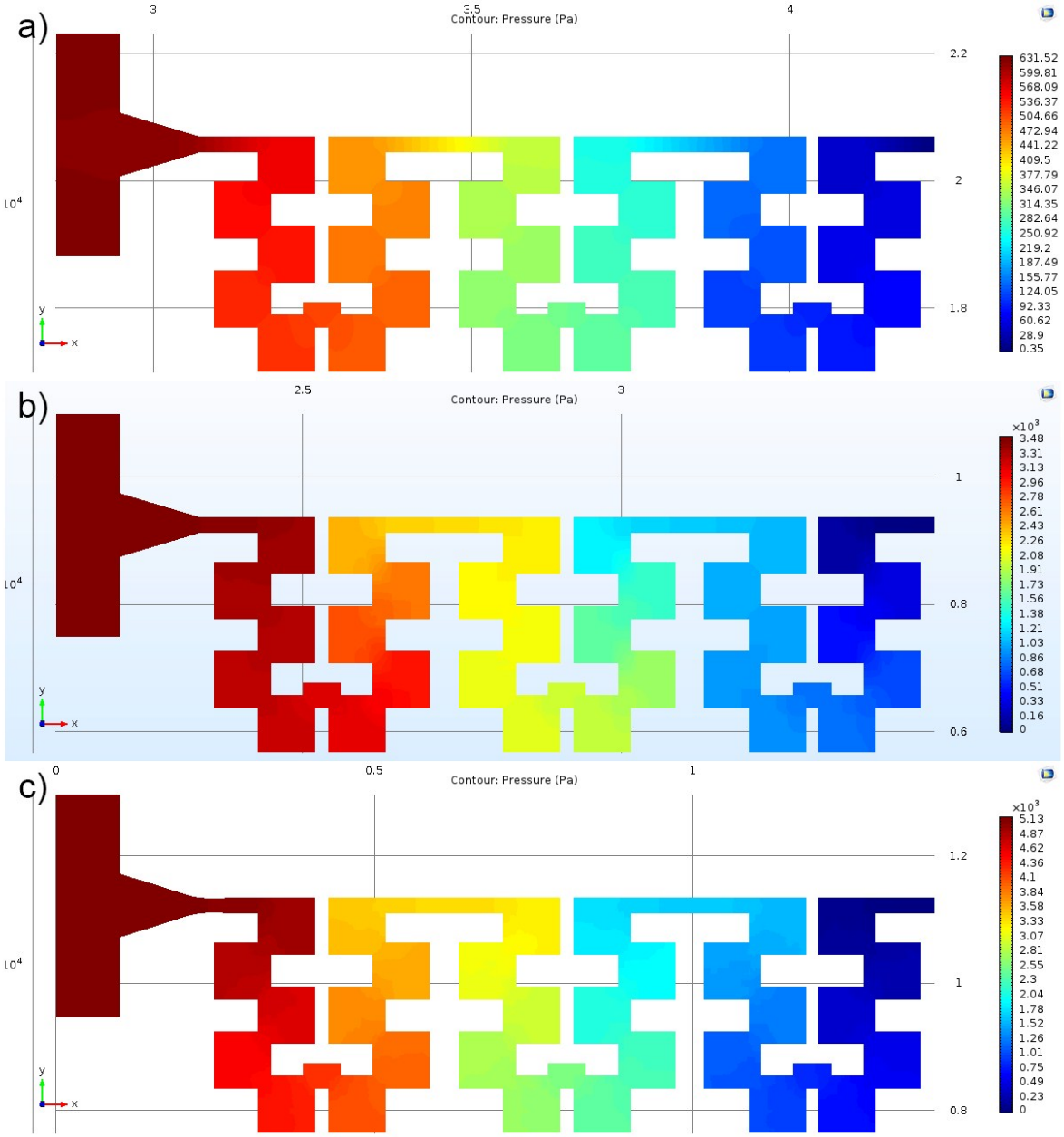
To obtain a high resolution scanning electron microscopy (SEM) image of the microfluidic structure, the sample surfaces were first coated by a thin layer of iridium by Emitech K575X Sputter Coater prior to imaging. The SEM images were obtained by using Philips XL30 ESEM with electron beam of 3.0 kV.

3D Models of Variable Height Micromixers (VHMs)

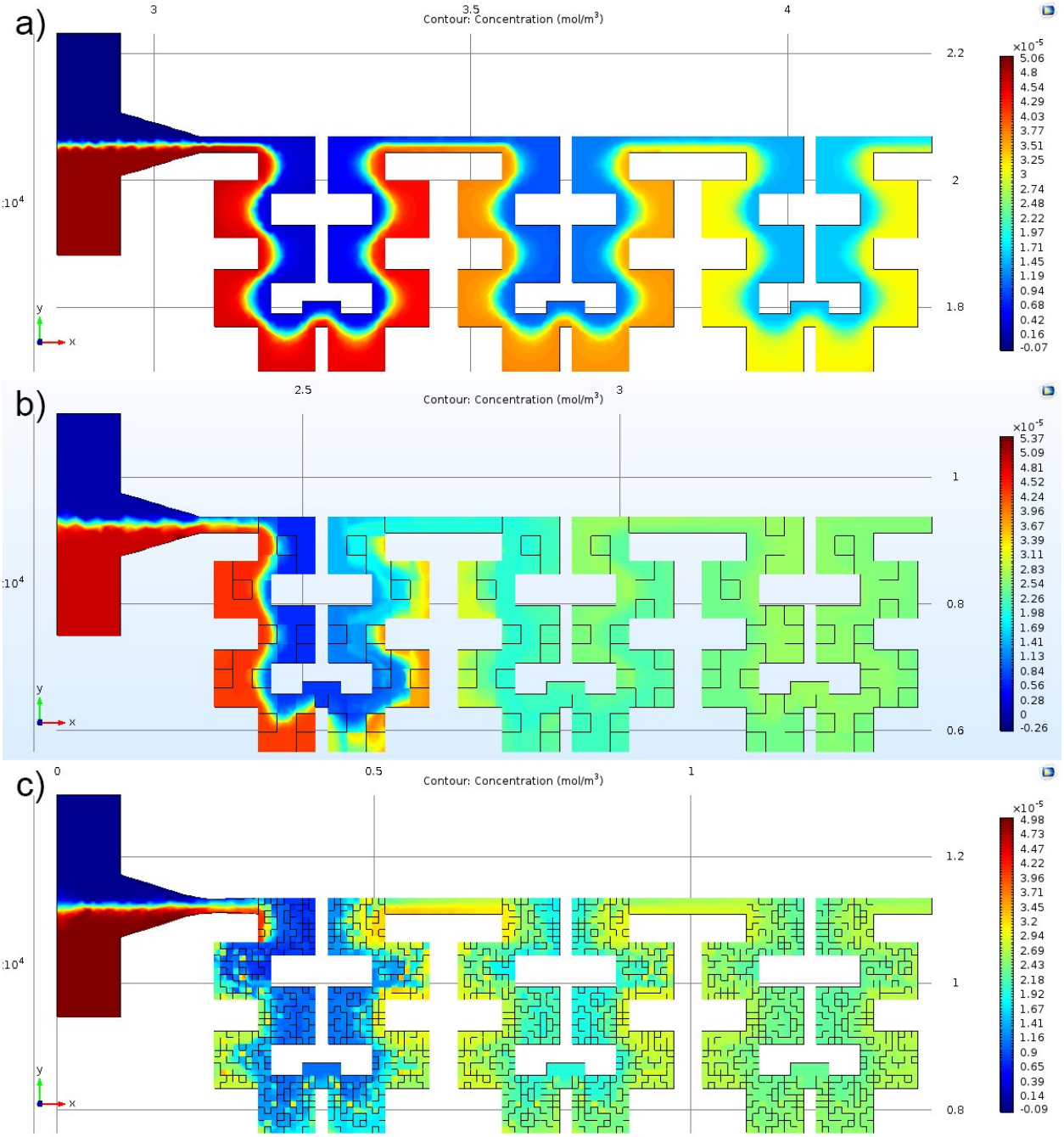
The three variations of the VHMs (1x1-unit, 3x3-unit, and 9x9-unit) were created in a computer-aided design software (AutoCAD), and converted into .STL format readable by finite-element method analysis software (COMSOL):



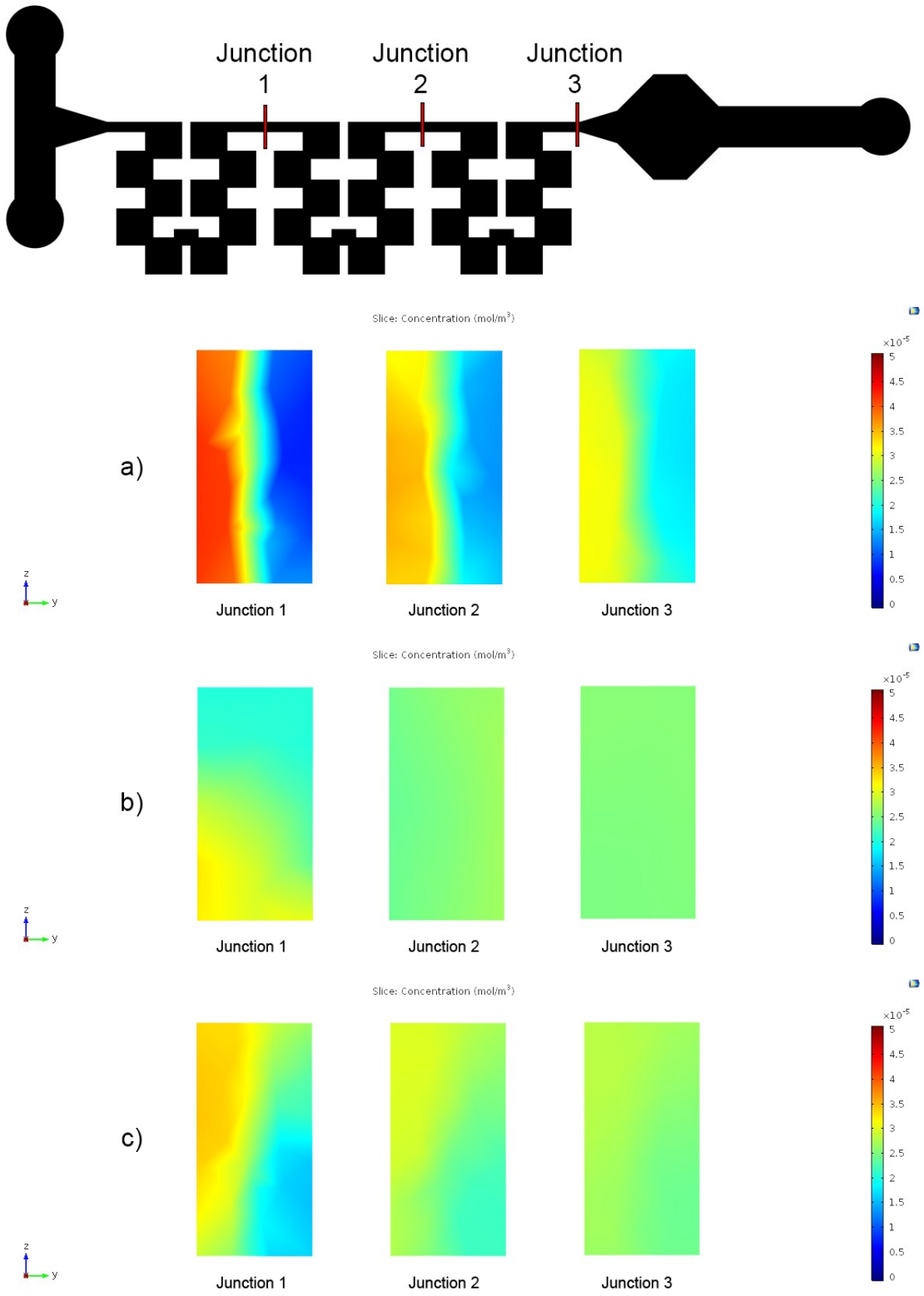
ESI Figure S1 - Computer-generated models of each of the micromixing regions of the a) 1x1-unit VHM, b) 3x3-unit VHM, and c) 9x9-unit VHM.



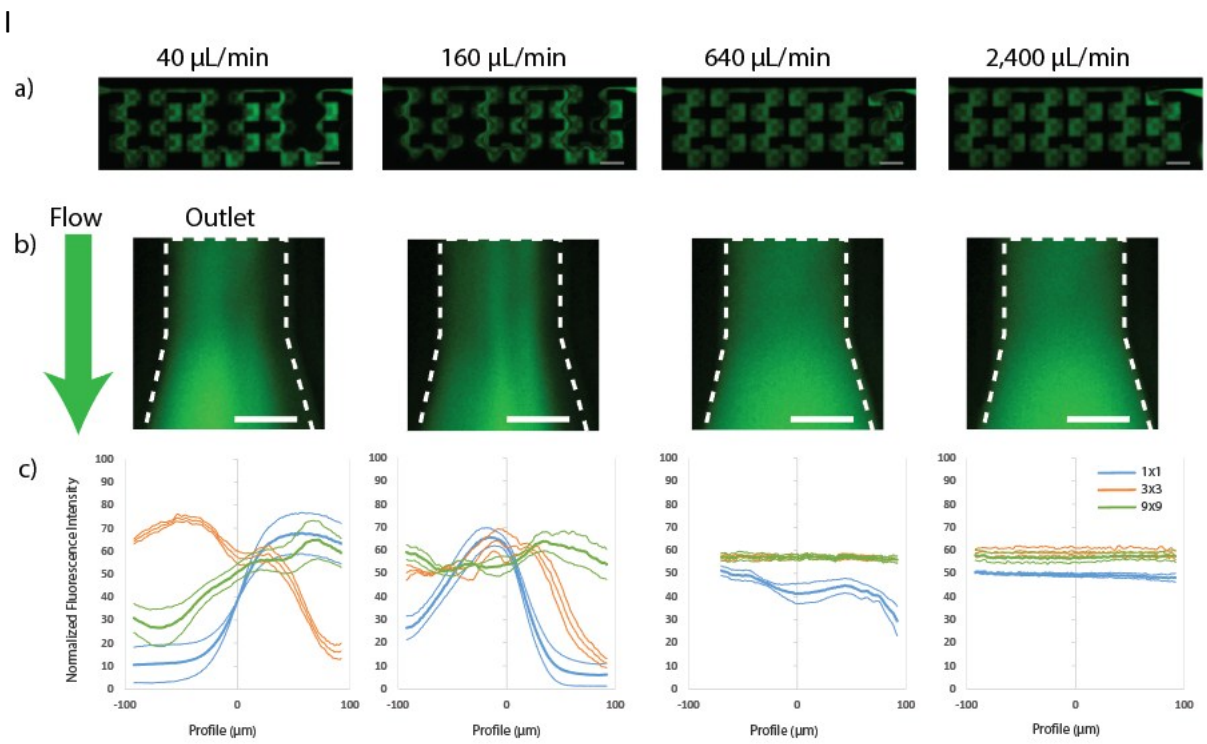
ESI Figure SI2 | Theoretical pressure drop across the micromixing regions of the a) 1x1-unit VHM, b) 3x3-unit VHM, and c) 9x9-unit VHM.



ESI Figure SI3 | Theoretical concentration map across the micrimixing regions of the a) 1x1-unit VHM, b) 3x3-unit VHM, and c) 9x9-unit VHM.



ESI Figure SI4 | Theoretical concentration map of each of the three exit junctions of each chain of macro-squares across the a) 1x1-unit VHM, b) 3x3-unit VHM, and c) 9x9-unit VHM.



ESI Figure SI5 Mixing behavior of VHM devices. a) Fluorescent images of a 3x3-unit VHM device across the total length of the zigzag micromixer (scale bar=1mm). b) Fluorescent images of the outlet of a 3x3-unit VHM at 40, 160, 640, and 2.4 ml/min (scale bar=100 um) where the c) intensity profiles were analyzed (blue= 1x1-unit, orange=3x3-unit, green=81x1x1-unit, error bars= SEM, n=3)

ESI Movie Captions:

ESI Movie SI1. Theoretical simulation results (velocity) for the 1x1 VHM. Cross-section views of velocity profile at 1,280 µL/min.

ESI Movie SI2. Theoretical simulation results (concentration) for the 1x1 VHM. Cross-section views of concentration profile at 1,280 µL/min.

ESI Movie SI3. Theoretical simulation results (velocity) for the 3x3 VHM. Cross-section views of velocity profile at 1,280 µL/min.

ESI Movie SI4. Theoretical simulation results (concentration) for the 3x3 VHM. Cross-section views of concentration profile at 1,280 µL/min.

ESI Movie SI5. Theoretical simulation results (velocity) for the 9x9 VHM. Cross-section views of velocity profile at 1,280 µL/min.

ESI Movie SI6. Theoretical simulation results (concentration) for the 9x9 VHM. Cross-section views of concentration profile at 1,280 µL/min.

ESI Movie SI7. In-device fabrication. Video captured with a UV filter over 50 seconds. Prepolymer solution is flowed in from the two inlet ports and mixed through the VHM. The syringe pump stops and the outlet clamped. The masks are loaded and the UV exposure begins and lasts for 30 seconds. The resultant structure is visualized after the mask is removed.