Rapid Prototyping of High-resolution Large Format Microfluidic Device through Maskless Image Guided In-situ Photopolymerization

Supplementary Materials

Ratul Paul[1], Yuwen Zhao[2], Declan Coster[3], Xiaochen Qin[2], Khayrul Islam[1,] and Yaling Liu[1,2,*]

[1] Department of Mechanical Engineering and Mechanics, Lehigh University, Bethlehem, Pennsylvania, USA
[2] Department of Bioengineering, Lehigh University, Bethlehem, Pennsylvania, USA
[3] Department of Electrical and Computer Engineering, Lehigh University, Bethlehem, Pennsylvania, USA

Measurement of $d_{critical}$ from serial exposure

To determine $d_{critical}$, we first make 4 blank channels with the same thickness. 50% PEGDA 700 is used with the same UV dose for each row. The patterns of circular micropillar of the same diameter of 35 µm but different gap distances are projected in a single file as shown in Figure S1**.** After projecting all the patterns, they are imaged, and the diameter is measured using ImageJ. Micropillars of small gap distance <100 µm are found to have increased size over sequential projection due to accumulated curing in the same area. Micropillars with gap distance above 150 µm are found to remain the original target diameter, thus $d_{critical}$ is chosen as 150 µm for later array fabrication to avoid accumulated over curing.

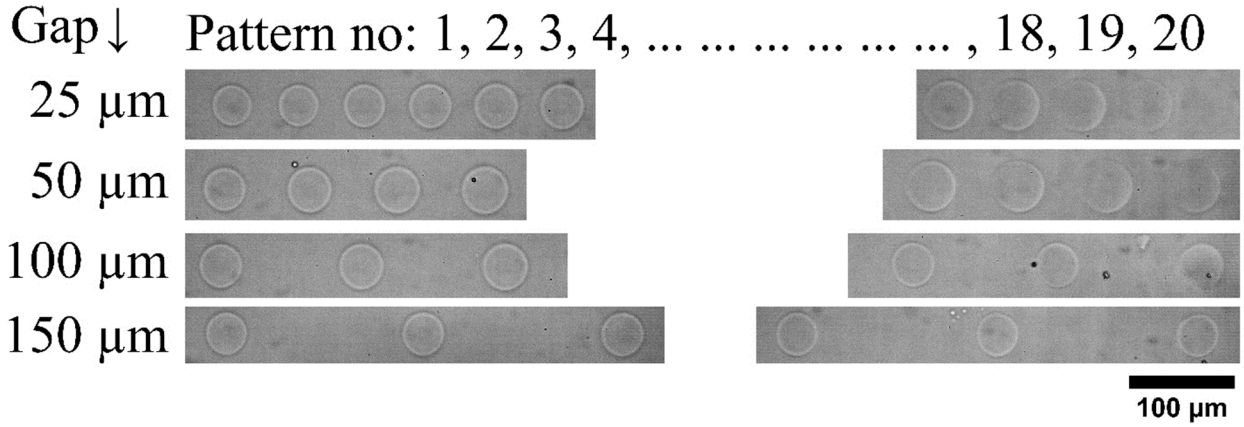

Figure S1: Shows the first and last few patterns in the serial exposure test with different gap size.

Experimental setup

The experimental setup includes the microscope, UV projector, high-speed camera, and pressure pump and is centrally controlled by the computer with a python code. The setup is shown in Figure S2**.**

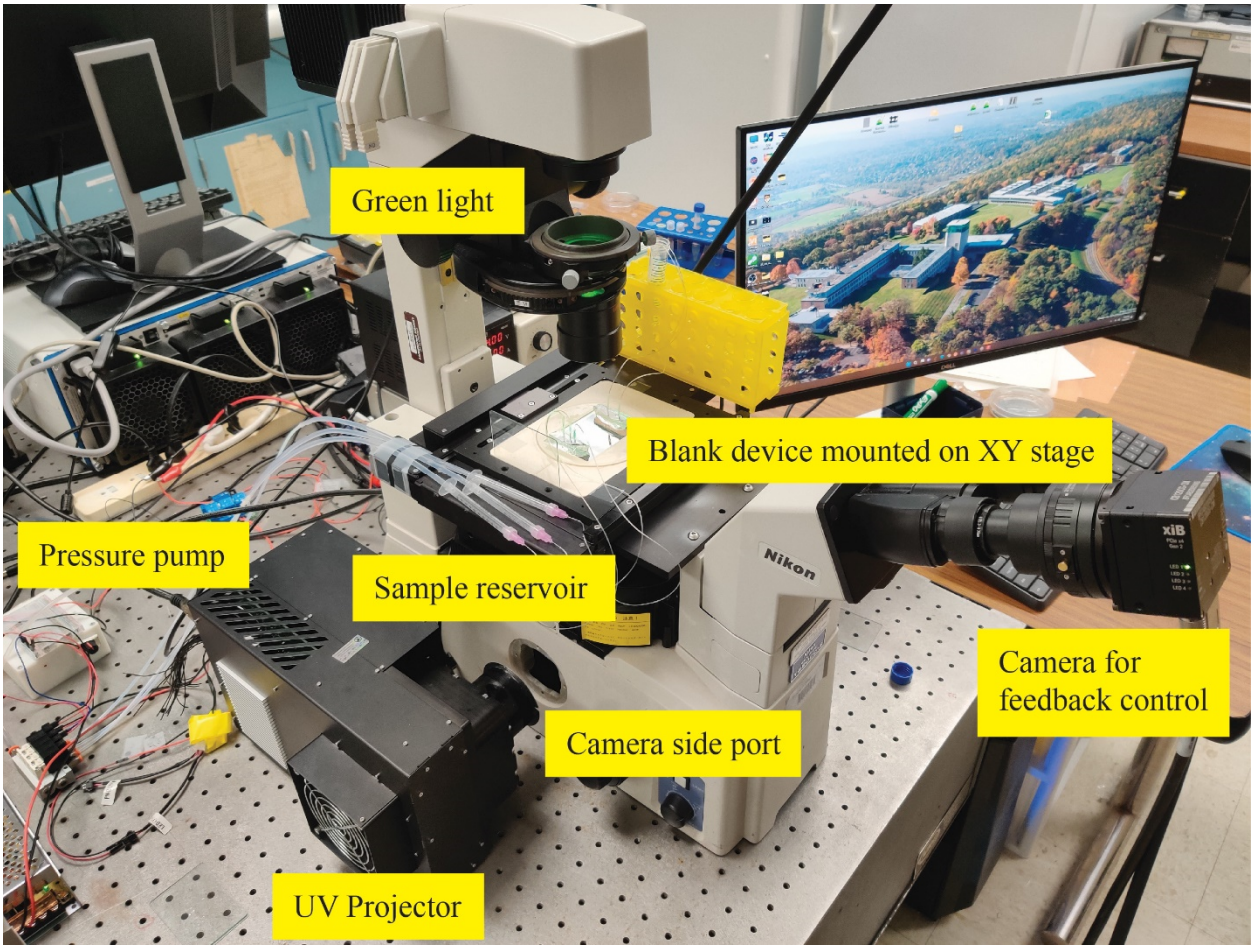

Figure S2: Experimental setup

Blank channel fabrication

The fabrication of the blank device is described in the methods section. The blank device is shown in Figure S3.

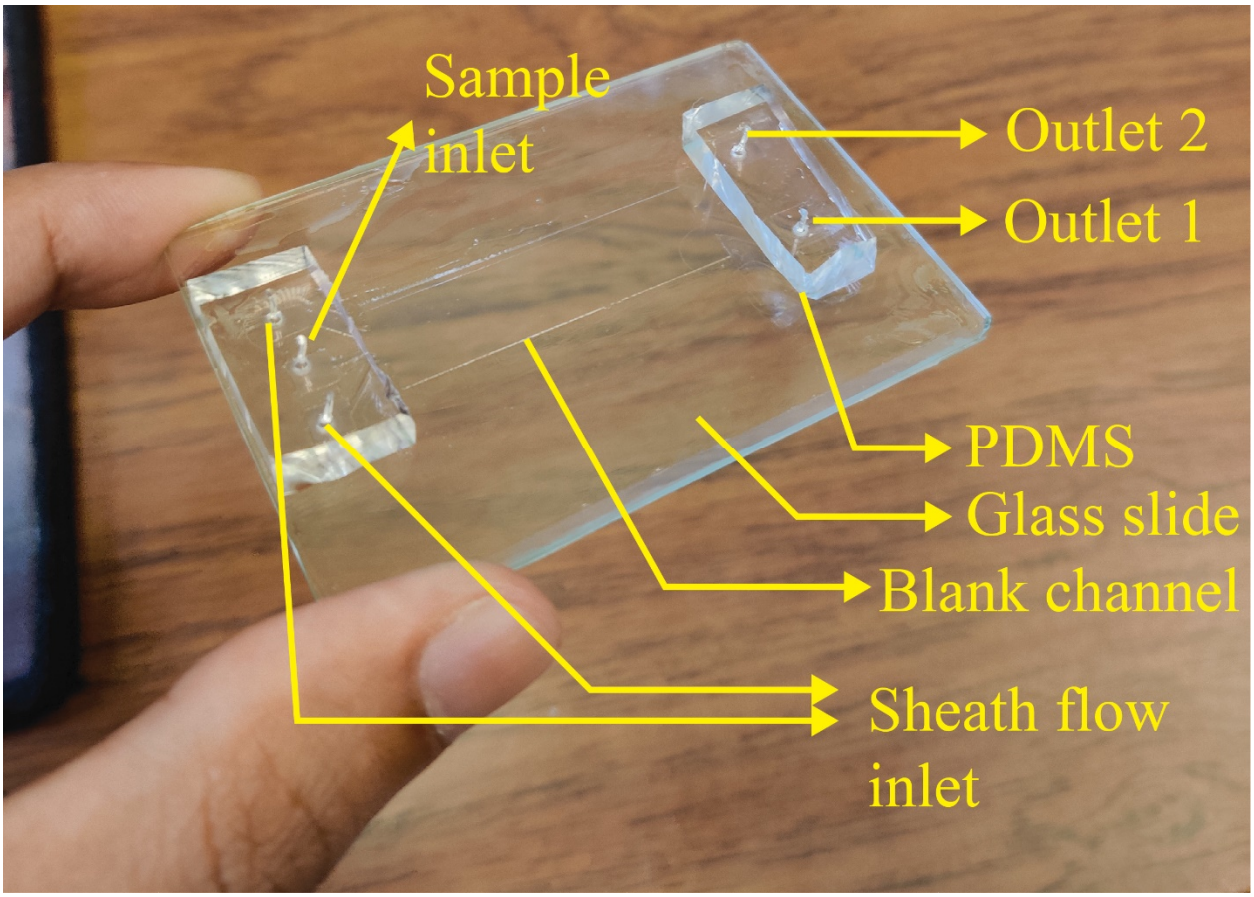

Figure S3: A blank channel for DLD device fabrication

Cell laden microstructures

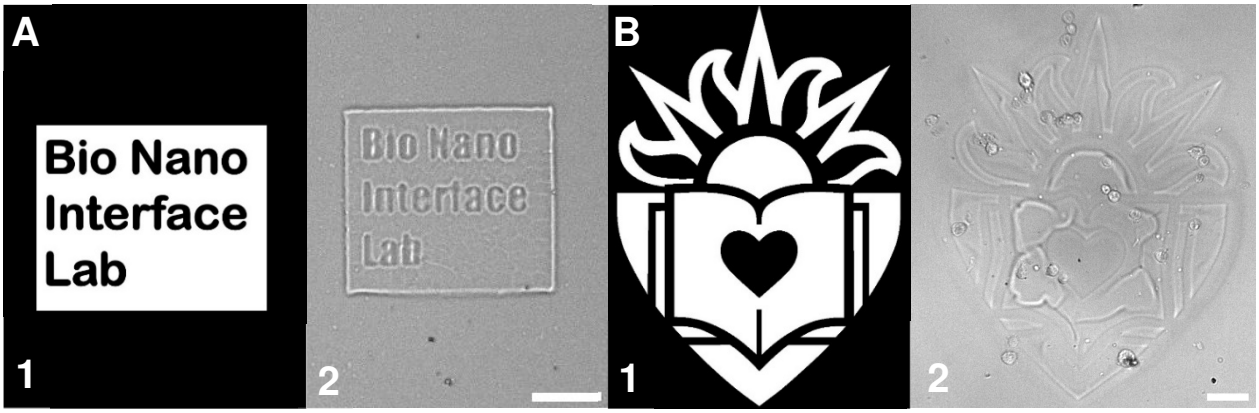

Figure S5: Complex pattern printing by GelMA hydrogel. A) Logo of the Bionano interface Lab. B) Logo of Lehigh University. Figures 1 and 2 represent for digital mask and the GelMA geometry. Scale bar: 50 µm.