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Supplementary information

A 'print–pause–print' protocol for 3D printing microfluidics using multimaterial stereolithography

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A "print-pause-print" protocol for 3D printing microfluidics using multimaterial stereolithography

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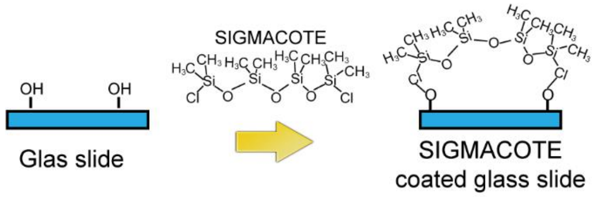

Fig S1. Schematic draw of hydrophobic coating procedure on the glass slide surface using SIGMACOTE.

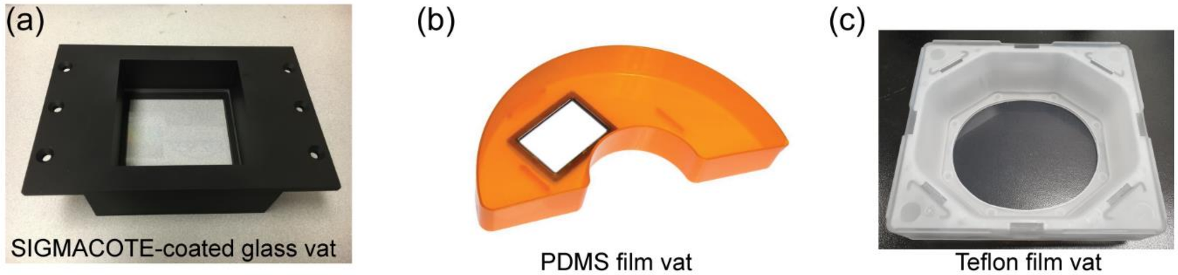

Fig. S2. Three types of 3D-printing resin vat. (a) SIGMACOTE-coated glass vat using ILIOS HD SLA 3D printer. (b) PDMS film vat from AutoCAD Ember 3D printer. (c) Teflon film vat from Asiga Pico2 HD.

(a) Transparent serpentine channel chip

Name	Minimum	Burn-In	1	Maximum	Units
Print Range From	0.000	0.000	0.025	4.400	mm
Print Range To	0.000	0.025	4.400	4.400	mm
Slice Thickness	0.001	0.025	0.025	0.410	mm
Slice Count	0	1	175		
Print Range Height	0.000	0.025	4.375	4.400	mm
◢ Advanced Settings					
Heater Temperature	0.0	25.0	25.0	50.0	°C
Minimum Temperature	0.0	25.0	25.0	50.0	°C
Heater Enable	0	1	1	1	
Light Intensity	0.01	32.21	32.21	42.29	mW/cm²
Light Intensity Control	0	1	1	1	
Exposure Time	0.017	5.000	0.300		s
Z Compensation	0.000	0.049	0.000	5.000	mm
Types of resin used		PEG-DA-250			

(b) Cross-channel diffusion chip

Name	Minimum	Burn-In	1	2	3	4	Maximum	Units
Print Range From	0.000	0.000	0.025	1.600	1.700	1.725	10.350	mm
Print Range To	0.000	0.025	1.600	1.700	1.725	5.780	10.350	mm
Slice Thickness	0.001	0.025	0.025	0.025	0.025	0.025	0.410	mm
Slice Count	0	1	63	4	1	162		
Print Range Height	0.000	0.025	1.575	0.100	0.025	4.050	10.350	mm
◢ Advanced Settings								
Heater Temperature	0.0	25.0	25.0	25.0	25.0	25.0	50.0	°C
Minimum Temperature	0.0	25.0	25.0	25.0	25.0	25.0	50.0	°C
Heater Enable	0	1	1	1	1	1	1	
Light Intensity	0.01	32.21	32.21	32.21	32.21	32.21	42.29	mW/cm²
Light Intensity Control	0	1	1	1	1	1	1	
Exposure Time	0.017	5.000	0.300	0.800	6.000	0.300		s
Z Compensation	0.000	0.049	0.000	0.000	0.062	0.000	5.000	mm
Types of resin used		PEG-DA-250		↑ PEG-DA-575	PEG-DA-250			

(c) Symmetric-channel diffusion chip

Name	Minimum	Burn-In	1	2	3	4	Maximum	Units
Print Range From	0.000	0.000	0.025	0.200	0.400	0.425	4.300	mm
Print Range To	0.000	0.025	0.200	0.400	0.425	4.300	4.300	mm
Slice Thickness	0.001	0.025	0.025	0.025	0.025	0.025	0.410	mm
Slice Count	0	1	7	8	1	155		
Print Range Height	0.000	0.025	0.175	0.200	0.025	3.875	4.300	mm
◢ Advanced Settings								
Heater Temperature	0.0	25.0	25.0	25.0	25.0	25.0	50.0	°C
Minimum Temperature	0.0	25.0	25.0	25.0	25.0	25.0	50.0	°C
Heater Enable	0	1	1	1	1	1	1	
Light Intensity	0.01	32.21	32.21	32.21	32.21	32.21	42.29	mW/cm²
Light Intensity Control	0	1	1	1	1	1	1	
Exposure Time	0.017	5.000	0.300	1.500	6.500	0.300		s
Z Compensation	0.000	0.049	0.000	0.003	0.069	0.000	5.000	mm
Types of resin used		PEG-DA-250		↑ 40% PEG-DA-700	PEG-DA-250			

Fig. S3. Screenshot images of microfluidic chip printing condition and printing resin. (a) Transparent serpentine channel chip. To print the transparent serpentine channel chip, a burn-in procedure was carried out with PEG-DA-250 resin for 5 s. After the burn-in layer, printing of the transparent serpentine channel chip was completed with UV-exposure time of 0.3 s per layer. (b) Cross-channel diffusion chip. After printing a burn-in layer of the cross-channel diffusion chip, a print range from 25 μm to 1600 μm was fabricated using PEG-DA-250 resin and then the resin was switched to PEG-DA-575 to print a porous barrier with print ranges from 1600 μm to 1700 μm. Again, switching the resin to PEG-DA-250, the print ranges from 1700 μm to 1725 μm were printed with 6 s UV over-exposure to fill the 100 μm-thick space around the porous barrier. The print range from 1725 μm to 5780 μm was fabricated exposing UV light for 0.3 s per sliced layer. (c) Symmetric-channel diffusion chip. Prior to printing a channel layer for the symmetric-channel diffusion chip, a burn-in layer was produced by using a PEG-DA-250 resin with 5 s exposure time. Then, the bottom layers and the first 4 layers of channel part 1 (the print ranges from 25 μm to 200 μm) were built with 0.3 s exposure time. After changing the resin to 40% PEG-DA-700, 8 layers of porous barrier (the print ranges from 200 μm to 400 μm) were fabricated by exposing UV light for 1.5 s per layer. The printing resin was switched again to PEG-DA-250, and the sidewall of the channel part 1 was completed by UV over-exposure for 6.5 s. The last portion of the symmetric-channel diffusion chip (the print ranges from 425 μm to 4300 μm) was fabricated with 0.3 s exposure time by using PEG-DA-250 resin.