

3D microfluidic cloth-based analytical devices at a single piece of cloth by one-step laser hydrophilicity modification

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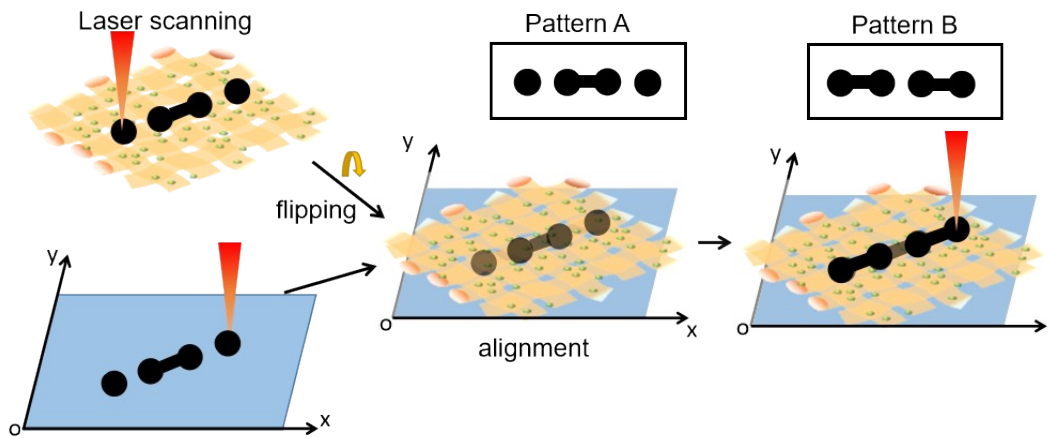


Fig. S1 Double-sided processing step diagram. First, the hydrophilic pattern A was processed on the top surface of the cotton fabric, and then the cotton fabric cloth was flipped to align with the pattern A processed on the fixed base template. Then, the hydrophilic pattern B was processed on the bottom surface of the cotton fabric by laser.

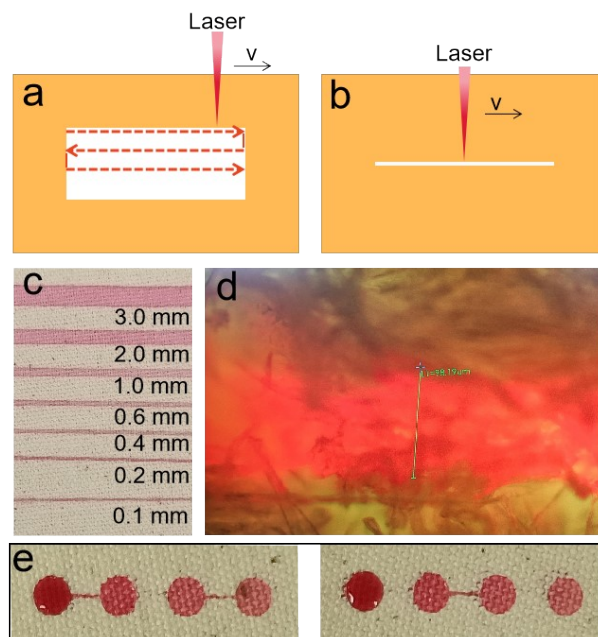


Fig. S2 (a) Laser scanning path of a microchannel. (b) The resolution was studied by scanning a single straight line. (c) Microchannels of different widths. (d) The microscopic image of the narrowest microchannel ($\sim 100 \mu m$) fabricated through laser-scanning a line. (e) A 3D- μ CAD with narrowest channels.

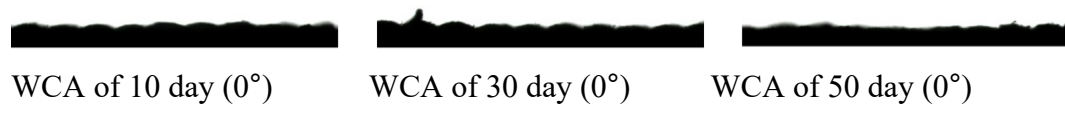


Fig. S3 Wetting durability of laser processing area of cotton fabric. The cotton fabric processed by laser remained superhydrophilic during the 50-day test cycle.

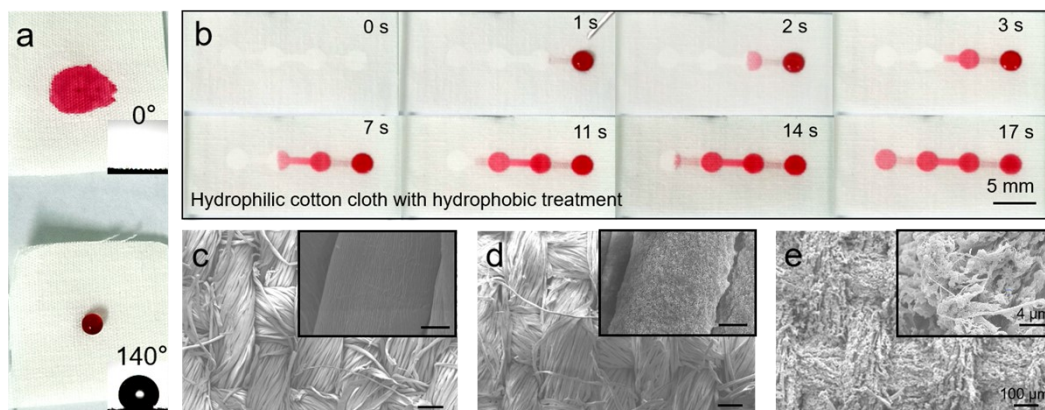


Fig. S4 (a) Image of dyed solution drops on hydrophilic cotton cloth and on hydrophobic cotton cloth. (The former was the original cloth, the latter was hydrophobic treated cloth) (b) Flow process of colorful drops in a 3D- μ CAD processed on hydrophilic cotton cloth with hydrophobic treatment. (c-e) SEM images of original hydrophilic <http://WYL/AppData/Local/youdao/dict/Application/8.9.9.0/resultui/html/index.html> - /javascript:cotton fabric, hydrophobic treated cotton fabric, laser processed cotton fabric.

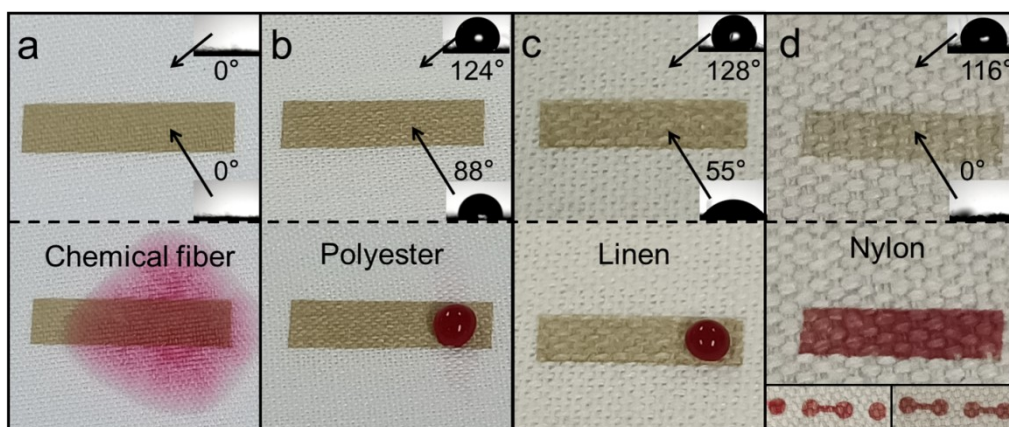


Fig. S5 (a-d) The water contact angle (WCA) of laser processed chemical\polyester\linen\nylon fabrics. The dark area was the processing area and colorful dye droplet was dripped in the processing area.

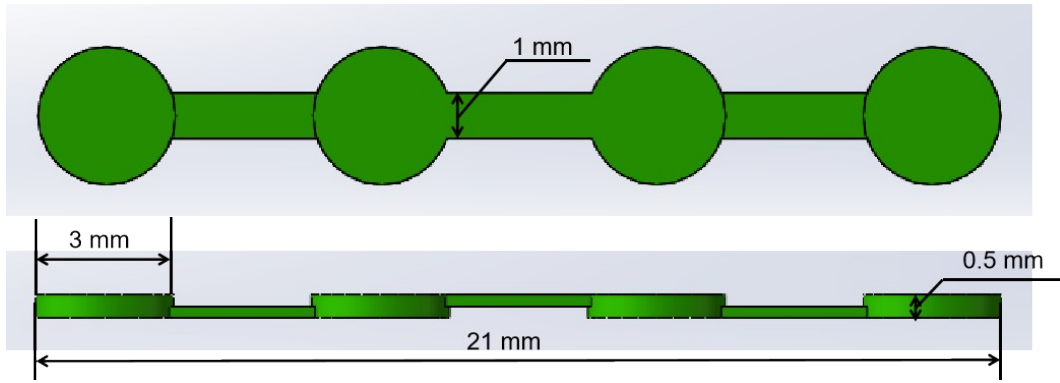


Fig. S6 The size of the 3D-μCAD.

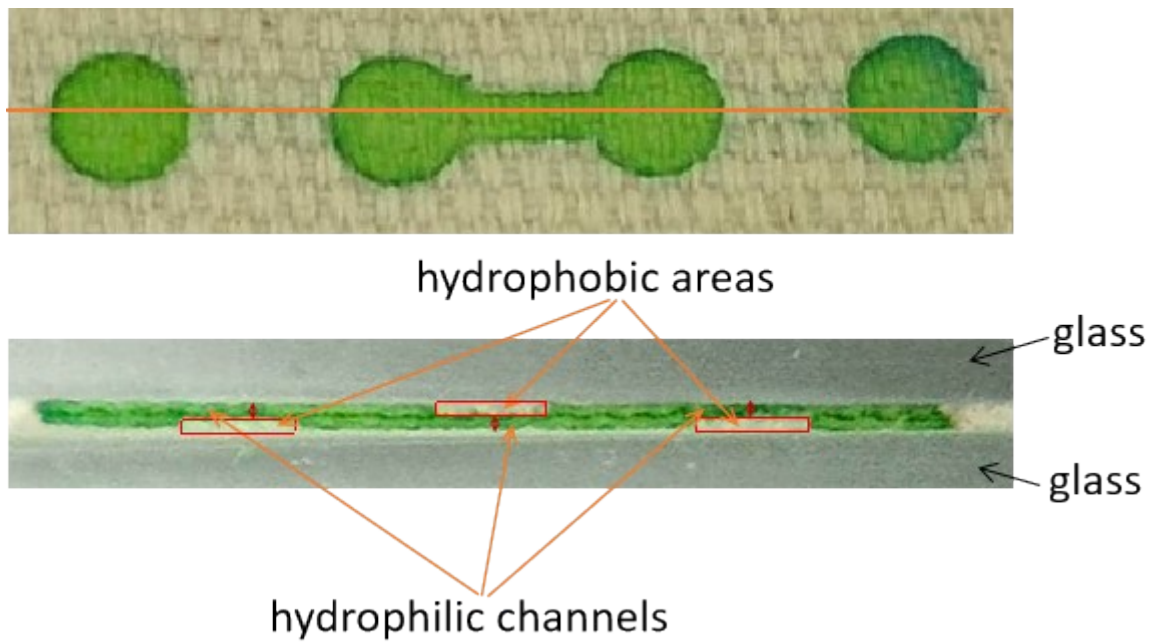


Fig. S7 Cross section of a 3D microfluidic device cut along a solid yellow line.

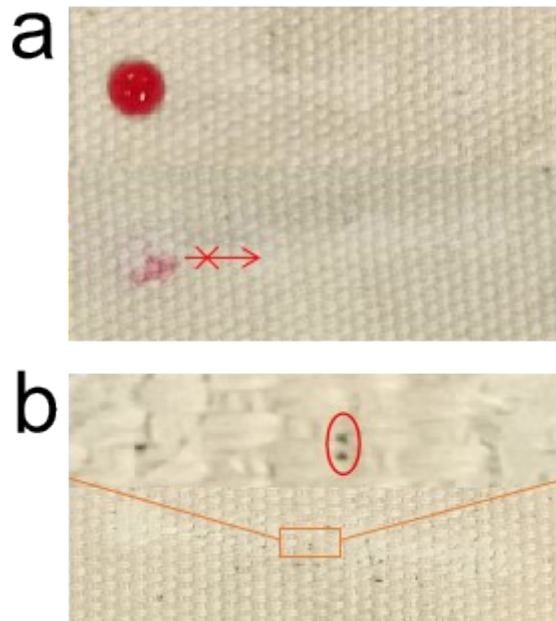


Fig. S8 a. Images of liquid unable to pass 3D microfluidic device with too low power. b. Images of 3D microfluidic device damaged with too high power

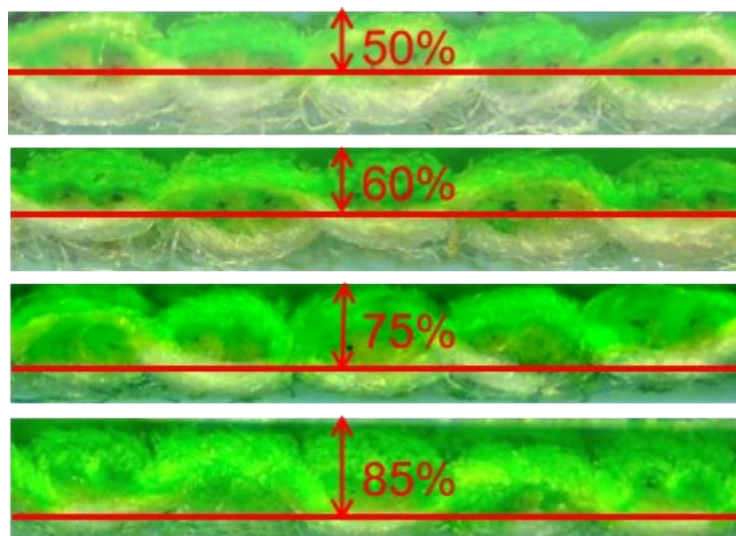


Fig. S9 The depth of hydrophilic layer obtained via laser scanning in 100 mW, 150 mW, 200 mW and 250 mW.

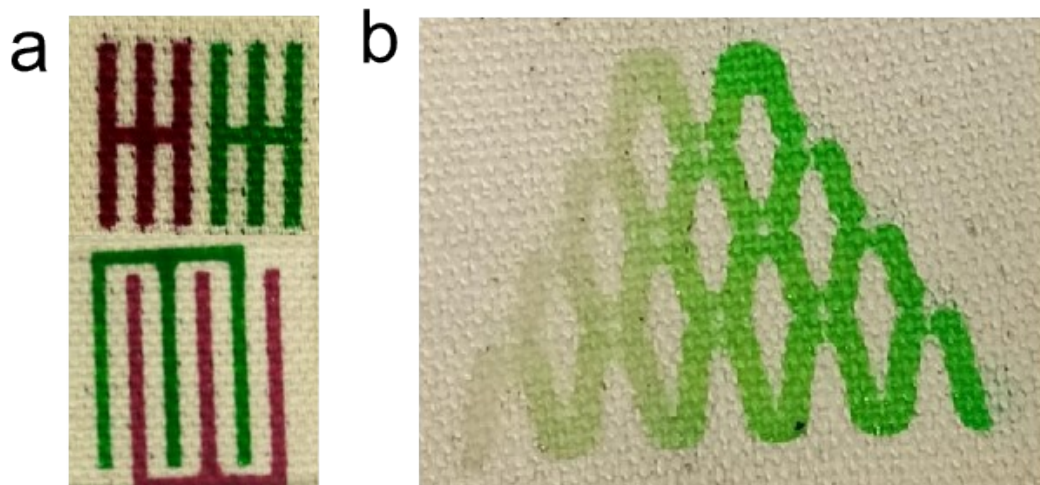


Fig. S10 a. Images of the bottom hydrophilic channel of liquid arrays. b. Image of the bottom hydrophilic channel of the six-level diluter.

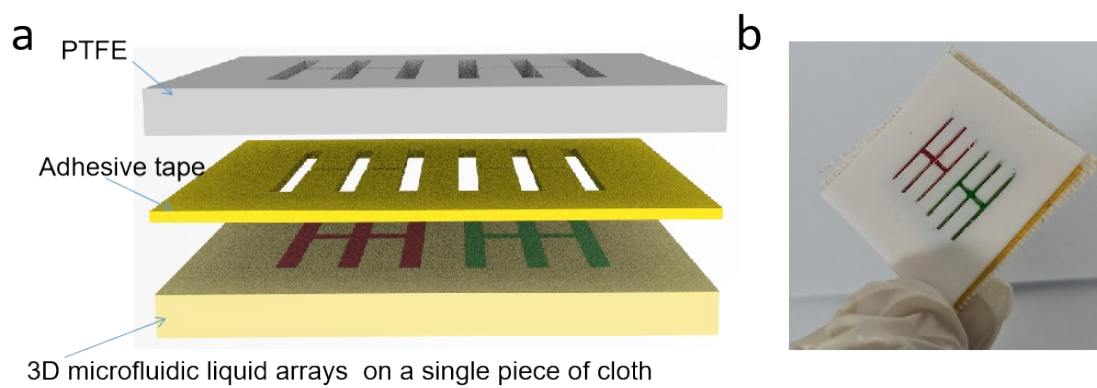


Fig. S11 a. Structural diagram of Liquid-arrays-stamp. b. Image of a Liquid-arrays stamp.

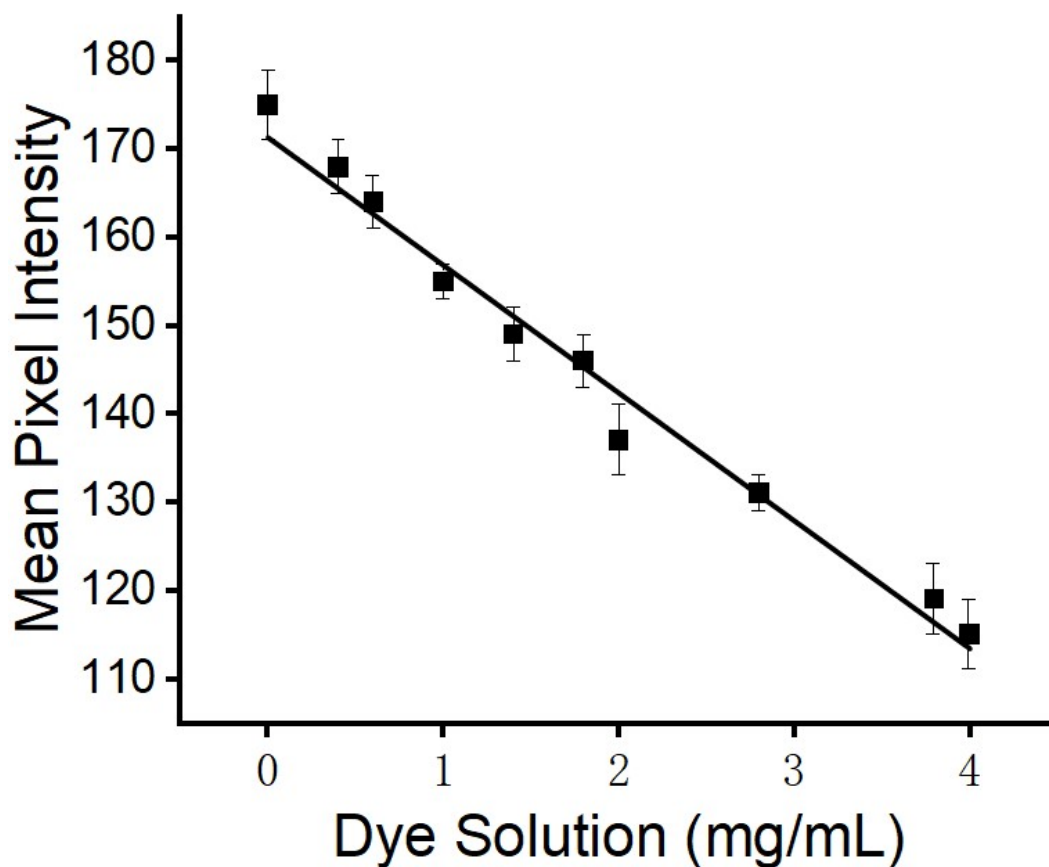


Fig. S12 Calibration curve for dye solution on cloth. We added the same known concentration of dye solution (25 μ l) to the two inlets of the diluter, so that dilution effect would not occur between the liquids, and the detection area at the end of the diluter would get the same color. The color of the detection area at the end of the diluter was recorded to obtain the correction curve of the pigment solution on the cloth.

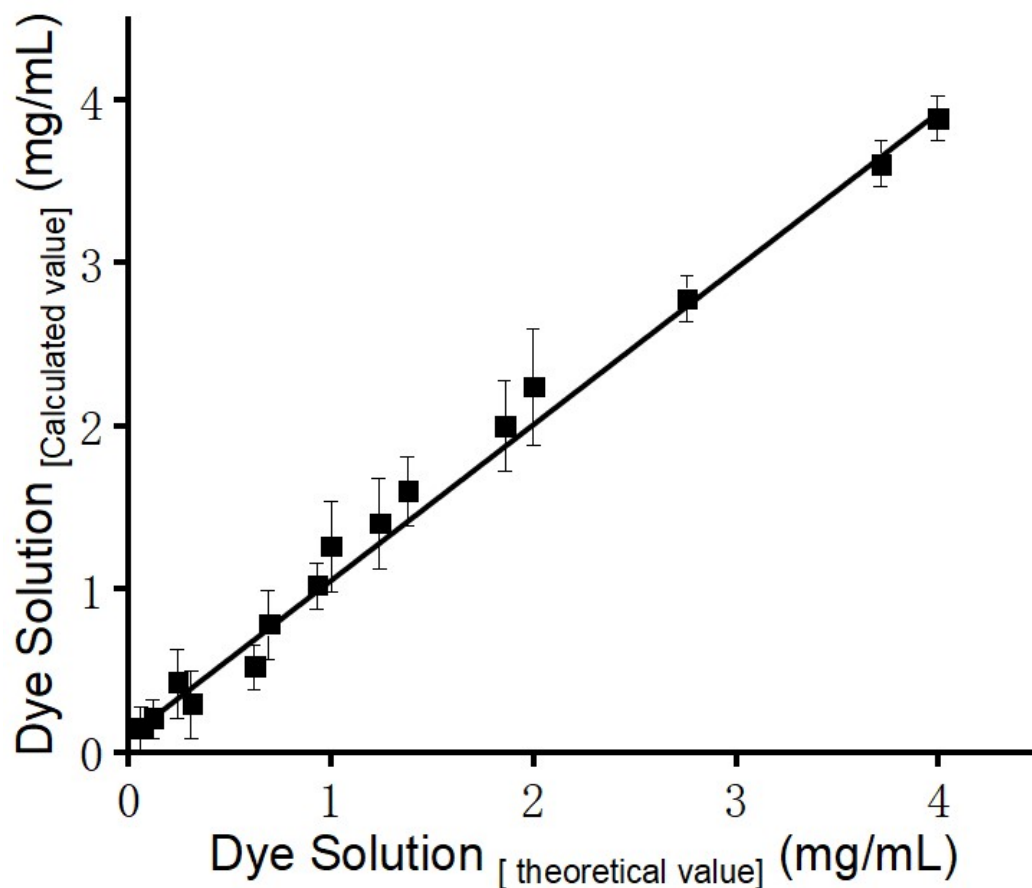


Fig. S13 Calculate the correlation between the concentration and the theoretical concentration. The calculated concentration is obtained from the calibration curve, and each point is obtained through three measurements. The line included represents a linear fit (slope = 0.96, $R^2 = 0.99$) between the two measurements and it is included to assess the limits of the technique.

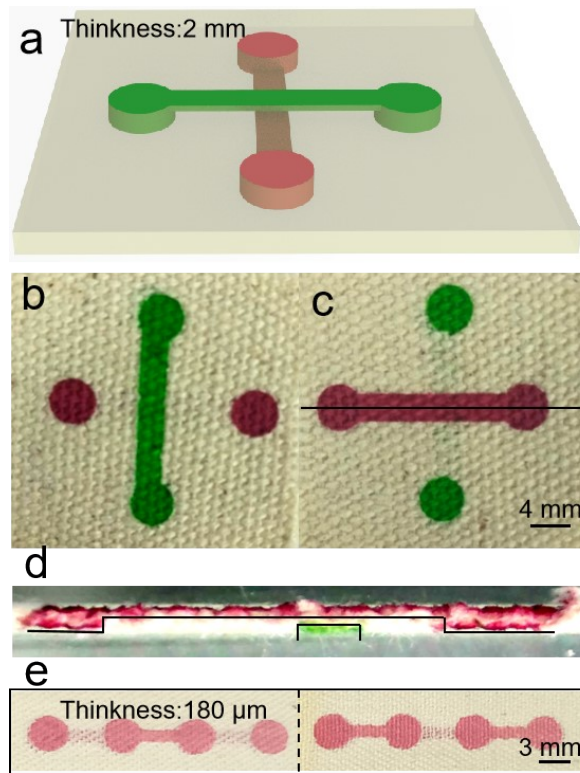


Fig. S14 (a) Schematic diagram of a 3D microfluidic channels on a 2 mm thickness cloth. (b) The view of the top surface of the 3D- μ CAD. (c) The view of the bottom surface of the 3D- μ CAD. (d) Cross section of the 3D- μ CAD. (e) Images of top and bottom surfaces of a 3D- μ CAD fabricated on a 180 μ m thick cloth.

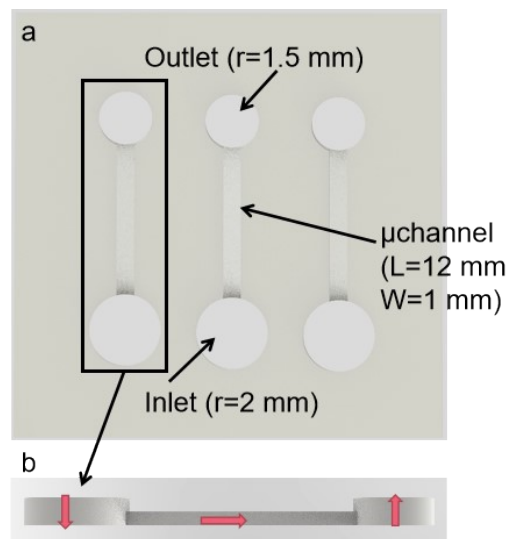


Fig. S15 (a) The size of the CAD used for blood type testing. (b) Schematic diagram of the detection area.

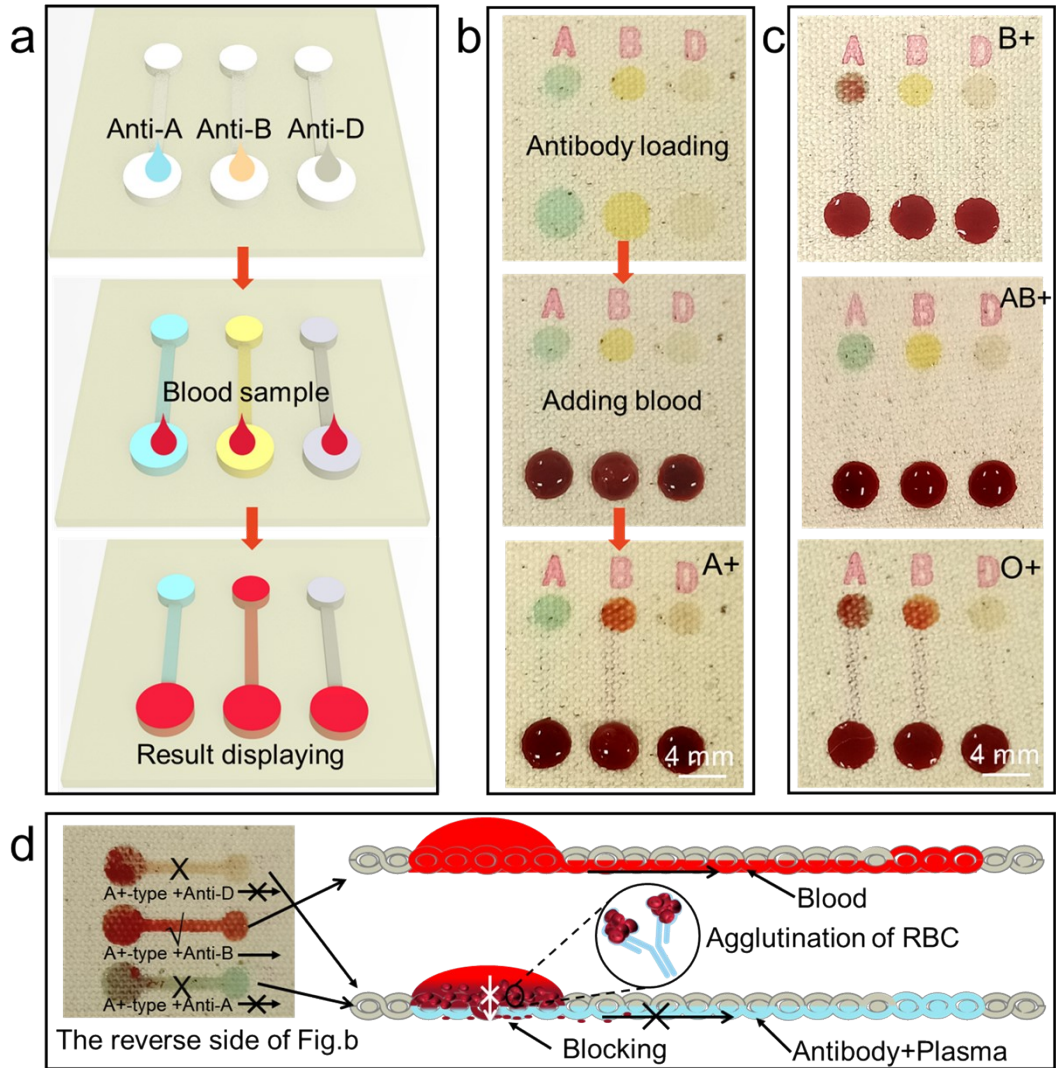


Fig. S16 (a) The process of blood type testing. (b) Images of the blood type A+ testing process. (c) results of blood type B+,AB+, O+ test. (Blood type B+ carried antigen-B and antigen-D but not antigen-A, so blood can only be observed at outlet A. For blood type AB+, there was no blood arriving at any of the three outlets because it carried antigen-A, -B and -D. Blood type O+ only carried antigen-D but not antigen-A, -B, thus, blood can eventually arrive at outlet A and B) (d) Schematic diagram of the mechanism of blood type detection.

Video S1 Liquid pass through the 3D- μ CAD@PC at a fast speed.

Video S2 Liquid pass through the 3D- μ CAD@PC at a slow speed.

Video S3 Liquid flow process that circular hydrophilic areas were connected by bottom microchannels to form a liquid array.

Video S4 Dropping dye solution at the bottom of the channel side to make the QR code hydrophilic region on the top discoloration.

Video S5 Introducing green dye solution to the visible inlet to make hidden information appear.