## **Supplementary Materials: Engineering of Removing Sacrificial Materials in 3D-Printed Microfluidics**

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**Figure S1.** Gray scale value of chip images after removing sacrificial material by air. Different parts of the chip are calculated respectively: (a) inlet of the channel, (b) front part of the channel, (c) rear part of the channel and (d) outlet of the channel. For each part of the chip, original picture, areas for gray scale value and statistics of gray scale value are presented. The scale bar is 1 mm.



**Figure S2.** Transmittance of the chip after removing sacrificial material by air. Transmittance of different parts of the chip are calculated respectively: (**a**) inlet of the channel, (**b**) front part of the channel, (**c**) rear part of the channel and (**d**) outlet of the channel. Average transmittance of the chip is also presented.



**Figure S3.** Gray scale value of chip images after removing sacrificial material by ethanol. Different parts of the chip are calculated respectively: (**a**) inlet of the channel, (**b**) front part of the channel, (**c**) rear part of the channel and (**d**) outlet of the channel. For each part of the chip, original picture, areas for gray scale value calculation and statistics of gray scale value are presented. The scale bar is 1 mm.



**Figure S4.** Transmittance of the chip after removing sacrificial material by ethanol. Transmittance of different parts of the chip are calculated respectively: (**a**) inlet of the channel, (**b**) front part of the channel, (**c**) rear part of the channel and (**d**) outlet of the channel. Average transmittance of the chip is also presented.



**Figure S5.** Transmittance of the chip after removing sacrificial material by vegetable oil. Transmittance of different parts of the chip are calculated respectively: (**a**) inlet of the channel, (**b**) front part of the channel, (**c**) rear part of the channel and (**d**) outlet of the channel. Average transmittance of the chip is also presented.



**Figure S6.** Gray scale value of chip images after removing sacrificial material by vegetable oil. Different parts of the chip are calculated respectively: (**a**) inlet of the channel, (**b**) front part of the channel, (**c**) rear part of the channel and (**d**) outlet of the channel. For each part of the chip, original picture, areas for gray scale value calculation and statistics of gray scale value are presented. The scale bar is 1 mm.



**Figure S7.** Removing sacrificial materials by ethanol and oil in 3D-printed microfluidic chip with gray build materials (VisiJet® Techplast). (a) 3D-printed microfluidic chip with gray build materials (VisiJet® Techplast). (b) Gray scale pictures of the chip in (a) after removing sacrificial materials by oil. (c) Gray scale pictures of the chip in (a) after removing sacrificial materials by ethanol. (d) Transmittance of the chip in (a) after removing sacrificial materials by oil. (e) Transmittance of the chip in (a) after removing sacrificial material by oil. (e) Transmittance of the chip in (a) after removing sacrificial material by oil. (e) Transmittance of the chip in (a) after removing sacrificial material by ethanol. The scale bar is 1 mm.



**Figure S8.** Gray scale value of chip (VisiJet® Techplast material, gray) images after removing sacrificial material by oil. Different parts of the chip are calculated respectively: (**a**) inlet of the channel, (**b**) front part of the channel, (**c**) rear part of the channel and (d) outlet of the channel. For each part of the chip, original picture, areas for gray scale value and statistics of gray scale value are presented. The scale bar is 1 mm.

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**Figure S9.** Gray scale value of chip (VisiJet® Techplast material, gray) images after removing sacrificial material by ethanol. Different parts of the chip are calculated respectively: (**a**) inlet of the channel, (**b**) front part of the channel, (**c**) rear part of the channel and (**d**) outlet of the channel. For each part of the chip, original picture, areas for gray scale value and statistics of gray scale value are presented. The scale bar is 1 mm.



**Figure S10.** Gray scale value of chip images after removing sacrificial material at 60 °C. Different parts of the chip are calculated respectively: (**a**) inlet of the channel, (**b**) front part of the channel, (**c**) rear part of the channel and (**d**) outlet of the channel. For each part of the chip, original picture, areas for gray scale value calculation and statistics of gray scale value are presented. The scale bar is 1 mm.



**Figure S11.** Transmittance of the chip after removing sacrificial material at 60 °C. Transmittance of different parts of the chip are calculated respectively: (**a**) inlet of the channel, (**b**) front part of the channel, (**c**) rear part of the channel and (**d**) outlet of the channel. Average transmittance of the chip is also presented.



**Figure S12.** Gray scale value of chip images after removing sacrificial material at 80 °C. Different parts of the chip are calculated respectively: (**a**) inlet of the channel, (**b**) front part of the channel, (**c**) rear part of the channel and (**d**) outlet of the channel. For each part of the chip, original picture, areas for gray scale value calculation and statistics of gray scale value are presented. The scale bar is 1 mm.



**Figure S13.** Transmittance of the chip after removing sacrificial material at 80 °C. Transmittance of different parts of the chip are calculated respectively: (**a**) inlet of the channel, (**b**) front part of the channel, (**c**) rear part of the channel and (**d**) outlet of the channel. Average transmittance of the chip is also presented.



**Figure S14.** Gray scale value of chip images after 1 minute removing. Different parts of the chip are calculated respectively: (**a**) inlet of the channel, (**b**) front part of the channel, (**c**) rear part of the channel and (**d**) outlet of the channel. For each part of the chip, original picture, areas for gray scale value calculation and statistics of gray scale value are presented. The scale bar is 1 mm.





**Figure S15.** Transmittance of the chip after 1 minute removing. Transmittance of different parts of the chip are calculated respectively: (a) inlet of the channel, (b) front part of the channel, (c) rear part of the channel and (d) outlet of the channel. Average transmittance of the chip is also presented.



**Figure S16.** Gray scale value of chip images after 3 minutes removing. Different parts of the chip are calculated respectively: (**a**) inlet of the channel, (**b**) front part of the channel, (**c**) rear part of the channel and (**d**) outlet of the channel. For each part of the chip, original picture, areas for gray scale value calculation and statistics of gray scale value are presented. The scale bar is 1 mm.



**Figure S17.** Transmittance of the chip after 3 minutes removing. Transmittance of different parts of the chip are calculated respectively: (**a**) inlet of the channel, (**b**) front part of the channel, (**c**) rear part of the channel and (**d**) outlet of the channel. Average transmittance of the chip is also presented.



**Figure S18.** Gray scale value of chip images after 10 minutes removing. Different parts of the chip are calculated respectively: (**a**) inlet of the channel, (**b**) front part of the channel, (**c**) rear part of the channel and (**d**) outlet of the channel. For each part of the chip, original picture, areas for gray scale value calculation and statistics of gray scale value are presented. The scale bar is 1 mm.



**Figure S19.** Transmittance of the chip after 10 minutes removing. Transmittance of different parts of the chip are calculated respectively: (**a**) inlet of the channel, (**b**) front part of the channel, (**c**) rear part of the channel and (**d**) outlet of the channel. Average transmittance of the chip is also presented.



**Figure S20.** Gray scale value of chip images after 20 minutes removing. Different parts of the chip are calculated respectively: (a) inlet of the channel, (b) front part of the channel, (c) rear part of the channel and (d) outlet of the channel. For each part of the chip, original picture, areas for gray scale value calculation and statistics of gray scale value are presented. The scale bar is 1 mm.



**Figure S21.** Transmittance of the chip after 20 minutes removing. Transmittance of different parts of the chip are calculated respectively: (**a**) inlet of the channel, (**b**) front part of the channel, (**c**) rear part of the channel and (**d**) outlet of the channel. Average transmittance of the chip is also presented.



**Figure S22.** Gray scale value of chip images after 40 minutes removing. Different parts of the chip are calculated respectively: (**a**) inlet of the channel, (**b**) front part of the channel, (**c**) rear part of the channel and (**d**) outlet of the channel. For each part of the chip, original picture, areas for gray scale value calculation and statistics of gray scale value are presented. The scale bar is 1 mm.



**Figure S23.** Transmittance of the chip after 40 minutes removing. Transmittance of different parts of the chip are calculated respectively: (**a**) inlet of the channel, (**b**) front part of the channel, (**c**) rear part of the channel and (**d**) outlet of the channel. Average transmittance of the chip is also presented.



**Figure S24.** Gray scale value of chip images after 120 minutes removing. Different parts of the chip are calculated respectively: (**a**) inlet of the channel, (**b**) front part of the channel, (**c**) rear part of the channel and (**d**) outlet of the channel. For each part of the chip, original picture, areas for gray scale value calculation and statistics of gray scale value are presented. The scale bar is 1 mm.



**Figure S25.** Transmittance of the chip after 120 minutes removing. Transmittance of different parts of the chip are calculated respectively: (**a**) inlet of the channel, (**b**) front part of the channel, (**c**) rear part of the channel and (**d**) outlet of the channel. Average transmittance of the chip is also presented.



**Figure S26.** Gray scale value of chip images after 360 minutes removing. Different parts of the chip are calculated respectively: (**a**) inlet of the channel, (**b**) front part of the channel, (**c**) rear part of the channel and (**d**) outlet of the channel. For each part of the chip, original picture, areas for gray scale value calculation and statistics of gray scale value are presented. The scale bar is 1 mm.



**Figure S27.** Transmittance of the chip after 360 minutes removing. Transmittance of different parts of the chip are calculated respectively: (**a**) inlet of the channel, (**b**) front part of the channel, (**c**) rear part of the channel and (**d**) outlet of the channel. Average transmittance of the chip is also presented.



**Figure S28.** Gray scale value of chip images after 720 minutes removing. Different parts of the chip are calculated respectively: (**a**) inlet of the channel, (**b**) front part of the channel, (**c**) rear part of the channel and (**d**) outlet of the channel. For each part of the chip, original picture, areas for gray scale value calculation and statistics of gray scale value are presented. The scale bar is 1 mm.



**Figure S29.** Transmittance of the chip after 720 minutes removing. Transmittance of different parts of the chip are calculated respectively: (**a**) inlet of the channel, (**b**) front part of the channel, (**c**) rear part of the channel and (**d**) outlet of the channel. Average transmittance of the chip is also presented.



**Figure S30.** Chip images after different time of removal. (**a**) 1 minute, (**b**) 10 minutes, (**c**) 40 minutes and (**d**) 720 minutes. The scale bar is 1 cm.



**Figure S31.** Bright field and fluorescent chip images after 10 and 720 minutes removing. (**a**–**d**) Bright field images of the chip inlet (**a**), front (**b**), rear (**c**) and outlet (**d**) after 10 minutes removing. (**e**–**h**) Fluorescent images of the chip inlet (**e**), front (**f**), rear (**g**) and outlet (**h**) after 10 minutes removing. (**i**–1) Bright field images of the chip inlet (**i**), front (**j**), rear (**k**) and outlet (**l**) after 720 minutes removing. (m-p) Fluorescent images of the chip inlet (**m**), front (**n**), rear (**o**) and outlet (**p**) after 720 minutes removing. The scale bar is 1 mm.



**Figure S32.** Gray scale value of a rectangle cross-section chip after 10 minutes removing. Different parts of the chip are calculated respectively: (**a**) inlet of the channel, (**b**) front part of the channel, (**c**) rear part of the channel and (**d**) outlet of the channel. For each part of the chip, original picture, areas for gray scale value calculation and statistics of gray scale value are presented. The scale bar is 1 mm.



**Figure S33.** Transmittance of the rectangle cross-section chip after 10 minutes removing. Transmittance of different parts of the chip are calculated respectively: (a) inlet of the channel, (b) front part of the channel, (c) rear part of the channel and (d) outlet of the channel. Average transmittance of the chip is also presented.



**Figure S34.** Gray scale value of a circle cross-section chip after 10 minutes removing. Different parts of the chip are calculated respectively: (**a**) inlet of the channel, (**b**) front part of the channel, (**c**) rear part of the channel and (**d**) outlet of the channel. For each part of the chip, original picture, areas for gray scale value calculation and statistics of gray scale value are presented. The scale bar is 1 mm.



**Figure S35.** Transmittance of the circle cross-section chip after 10 minutes removing. Transmittance of different parts of the chip are calculated respectively: (**a**) inlet of the channel, (**b**) front part of the channel, (**c**) rear part of the channel and (**d**) outlet of the channel. Average transmittance of the chip is also presented.

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**Figure S36.** Gray scale value of a half-circle cross-section chip after 10 minutes removing. Different parts of the chip are calculated respectively: (**a**) inlet of the channel, (**b**) front part of the channel, (**c**) rear part of the channel and (**d**) outlet of the channel. For each part of the chip, original picture, areas for gray scale value calculation and statistics of gray scale value are presented. The scale bar is 1 mm.



**Figure S37.** Transmittance of the half-circle cross-section chip after 10 minutes removing. Transmittance of different parts of the chip are calculated respectively: (**a**) inlet of the channel, (**b**) front part of the channel, (**c**) rear part of the channel and (**d**) outlet of the channel. Average transmittance of the chip is also presented.



**Figure S38.** Gray scale value of a triangle cross-section chip after 10 minutes removing. Different parts of the chip are calculated respectively: (a) inlet of the channel, (b) front part of the channel, (c) rear part of the channel and (d) outlet of the channel. For each part of the chip, original picture, areas for gray scale value calculation and statistics of gray scale value are presented. The scale bar is 1 mm.



**Figure S39.** Transmittance of the triangle cross-section chip after 10 minutes removing. Transmittance of different parts of the chip are calculated respectively: (**a**) inlet of the channel, (**b**) front part of the channel, (**c**) rear part of the channel and (**d**) outlet of the channel. Average transmittance of the chip is also presented.



**Figure S40.** Transmittance results of four different cross-sections at 0, 1, 3, 5 and 10 minutes after removing inner sacrificial materials at 70 °C using vegetable oil.