Electronic supplementary information for "Functional patterning of PDMS microfluidic devices using integrated chemo-masks"

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In this supplement, we present additional micrographs showing the effects of varying the sub-dominant design parameters (shown in Figs. S1 through S4), and showing the results of the non-photo-activated fabrication route (shown in Fig. S5). All scale bars denote 100 μm.

Further design parameters

As described in the main text, the chemo-mask length is the most important design parameter. We also explored the effects of varying the chemo-mask wall thickness and width, the width of the channel to be masked, and the height of all features. Here, we detail our findings.

Wall thickness is important, but cannot be usefully adjusted very much: 20 μm walls work well, while 10 μm walls are too fragile to survive fabrication reliably, and 40 μm walls are too thick to pass sufficient oxygen reliably. Micrographs of devices with 20 μm and 40 μm walls, with visualized polymerization patterns, are shown in Figure S2; the device in the left panel is identical to the one shown in Fig. 1b of the main text. In the device with 20 μm walls, we see a clear masking effect; in the device with 40 μm walls, a masking effect can be still seen, but it is not as pronounced.

The area of the chemo-mask reservoirs (length times width for these rectangular reservoirs) must be great enough to hold sufficient oxygen to inhibit polymerization fully by counteracting all the available initiator molecules. We find that width of 750 μm is a threshold at which there is just enough oxygen in the reservoir to provide masking; chemo-masks with greater width and more oxygen still cover roughly the same channel region. This is shown in the micrographs of Figure S3.

The height of the features has little effect on the inhibited channel region. Devices with height 50 μm and 15 μm have similar inhibited regions, as shown in the micrographs of Figure S4.

Chemo-masks may be used to pattern flow channels up to 100 μm wide, as shown in Figure S5. The length of the inhibited region is similar for 20 μm, 30 μm, and 100 μm wide channels, although it has slightly irregular ends in the 100 μm wide channel. We note that the chemo-mask reservoirs for these devices are an irregular shape, but they have similar total area to the rectangular chemo-masks above and in the main text.

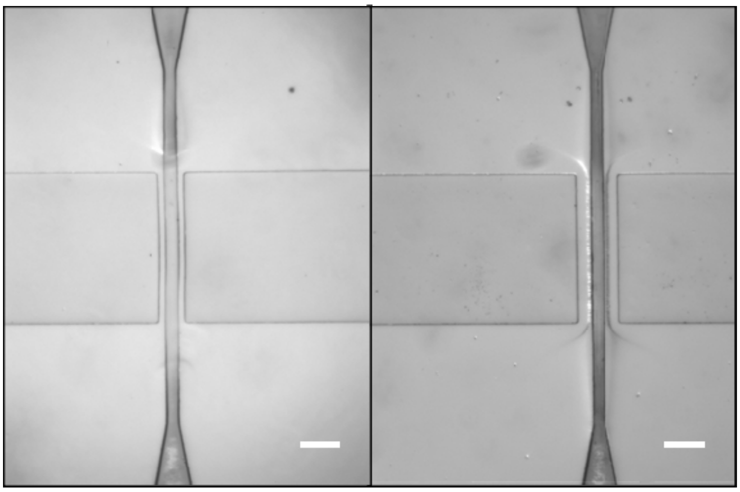


Figure S1: Micrographs of stained chemo-mask devices, with walls 20 µm thick (left) or 40 µm thick (right). Scale bars denote 100 µm.

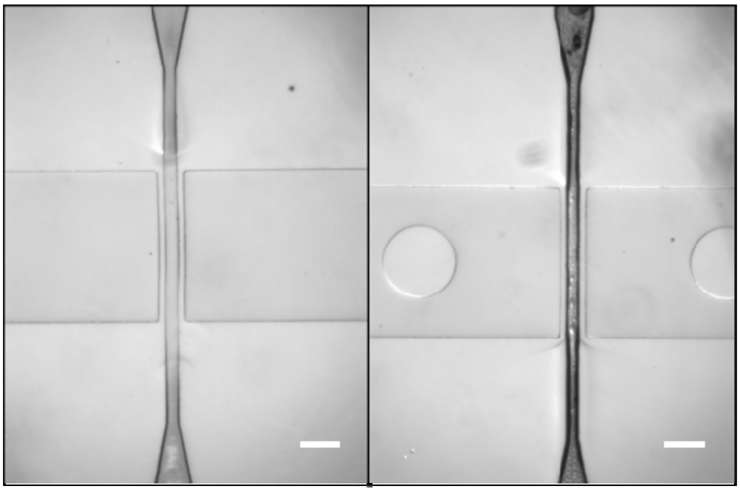


Figure S2: Micrographs of stained chemo-mask devices, with reservoirs 1500 µm wide (left) or 750 µm wide (right). Scale bars denote 100 µm.

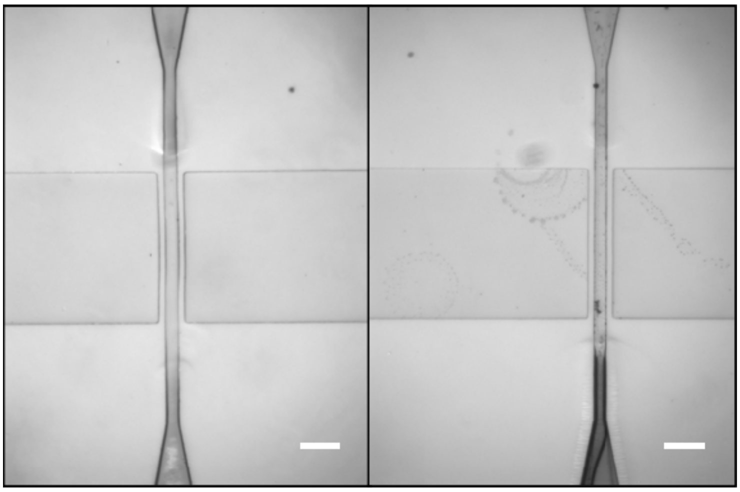


Figure S3: Micrographs of stained chemo-mask devices, with height of all features 50 µm (left) or 15 µm (right). Scale bars denote 100 µm.

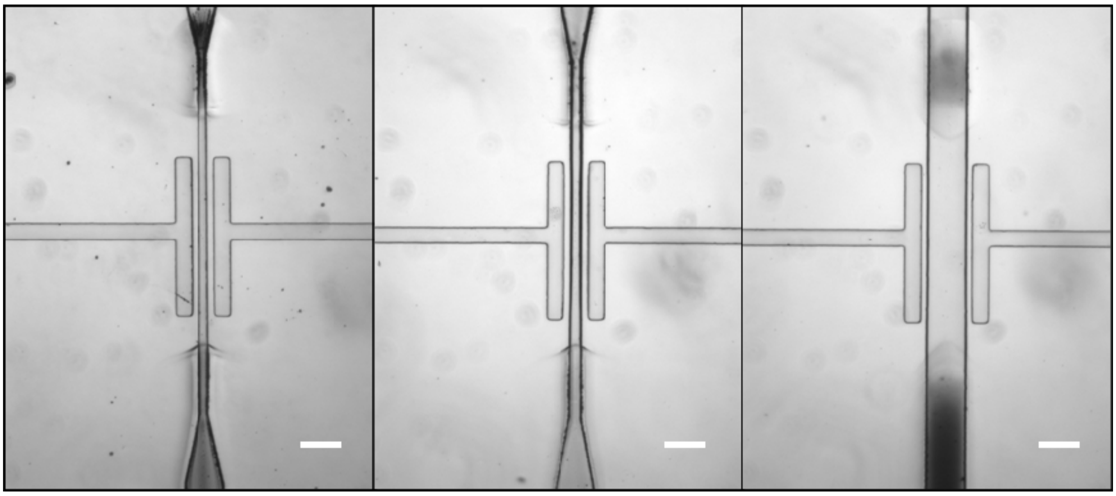


Figure S4: Micrographs of stained chemo-mask devices, with flow channels of width 20 µm (left), 30 µm (center), or 100 µm (right). Scale bars denote 100 µm.

Non-photo-activated surface chemistry

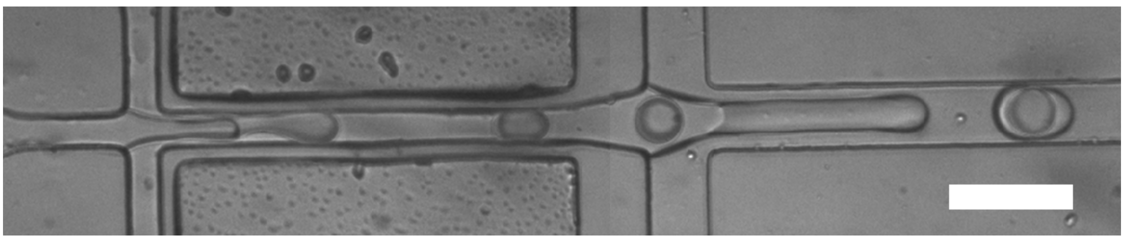
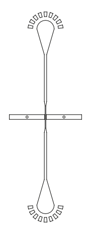


Fig. S5: Micrograph of double emulsion production, in a device made with chemo-masks using the non-photo-based surface chemistry described in the main text. Water-in-oil-in-water double emulsions have cores of deionized water and shells of HFE-7500 with

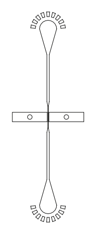
1.8%wt Krytox surfactant, and are dispersed in aqueous solution of poly(vinyl alcohol) at 5%wt. Scale bar denotes 100 μm.

Supplementary Material (ESI) for Lab on a Chip

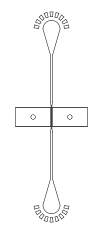
Designs for devices shown in "Functional patterning of PDMS microfluidic devices using integrated chemo-masks", by M. B. Romanowsky, M. Heymann, A. R. Abate, A. T. Krummel, S. Fraden, and D. A. Weitz, 2010.



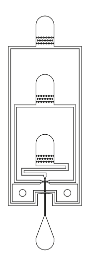
Length 200 micron (Fig. 1b)



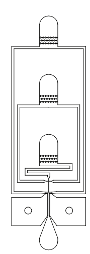
Length 400 micron (Fig. 1c)



Length 800 micron (Fig. 1d)



Water/oil/water device (Fig. 2a-b)



Oil/water/oil device (Fig. 2c-d)