# 7 Electronic Supplementary Information

## 7.1 SU-8 Master Mold: Processing Notes

An unfortunate consequence of spin casting over the top of existing resist structures is that during the spin process, small air bubbles may become entrained in the resist film on the leeward side (i.e., down the gravitational gradient) of the fluidic structures. This is particularly true for the thicker resists and tall rectangular structures employed here. Liberation of trapped air from SU-8 2150 was found, at times, to be quite challenging. The approach which produced the most consistently acceptable resist films consisted of heating the coated wafers on a level hotplate in a solvent rich atmosphere, i.e., fully covered, to 65 °C for $\approx$ 30 min. This allows adequate time for free air bubbles to float to the surface and rupture. Bubbles that did not rupture on their own were manually raptured using the sharp corner of a razor blade or syringe tip. This procedure was repeated as necessary and generally was found to be effective in removing better than 90% of trapped air. The other 10% were typically bubbles either held tightly to the Silicon surface or in the corners of the existing structures. These remaining few bubbles were removed by carefully dislodging them, again with the corner of a clean razor blade or syringe tip. The resist film, still being highly liquified at this stage, quickly settles into a mirror like surface leaving no trace of a disturbance.

## 7.2 Mold Replication in Silicone: Processing Notes

A slight roughening of the silicone surface was typically observed following the recovery the negative impression, see Figure S3. Presumably this is a result of an adverse reaction at the rubber surface during the caustic silanization step. This roughening was found to be benign, however, and did not effect the performance of the resulting MABs. Further investigation is required to definitively identify the source of the roughening. It is possible, for example, that a simple shortening of the silanization treatment time would lessen if not eliminate the surface roughness while still providing adequate release characteristics.

## 7.3 List of Supplemental Figures

- Fig. S1 - MAB photomask design.
- Fig. S2 - SU-8 master mold construction.
- Fig. S3 - Surface roughness of silicone replicates.
- Fig. S4 - Variations in MAB block thickness.
- Fig. S5 - Systematic variation in film thickness of prepared substrates

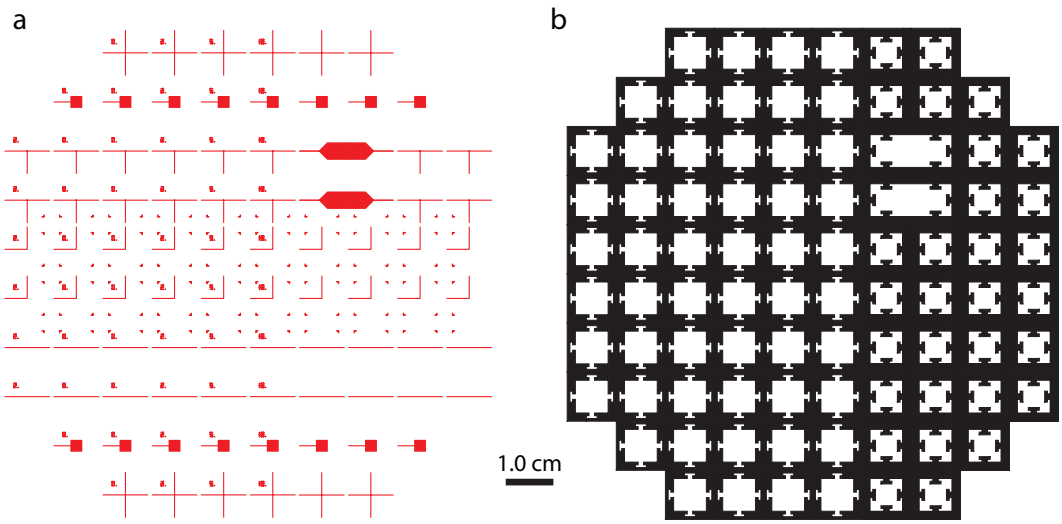


**Fig. S 1** Current MAB photomask design. (a) Assorted simple fluidic channel layouts consisting of straight, 90° turns, T-junctions, crosses, reaction chambers, and inlets/outlets. Channels are drawn at 200 $\mu$m wide. Numerical indications next to the male pieces correspond to the degree of MAB convexity in $\mu$m. (b) MAB walls for both male and female pieces with principle block dimensions of 8 x 8 mm.

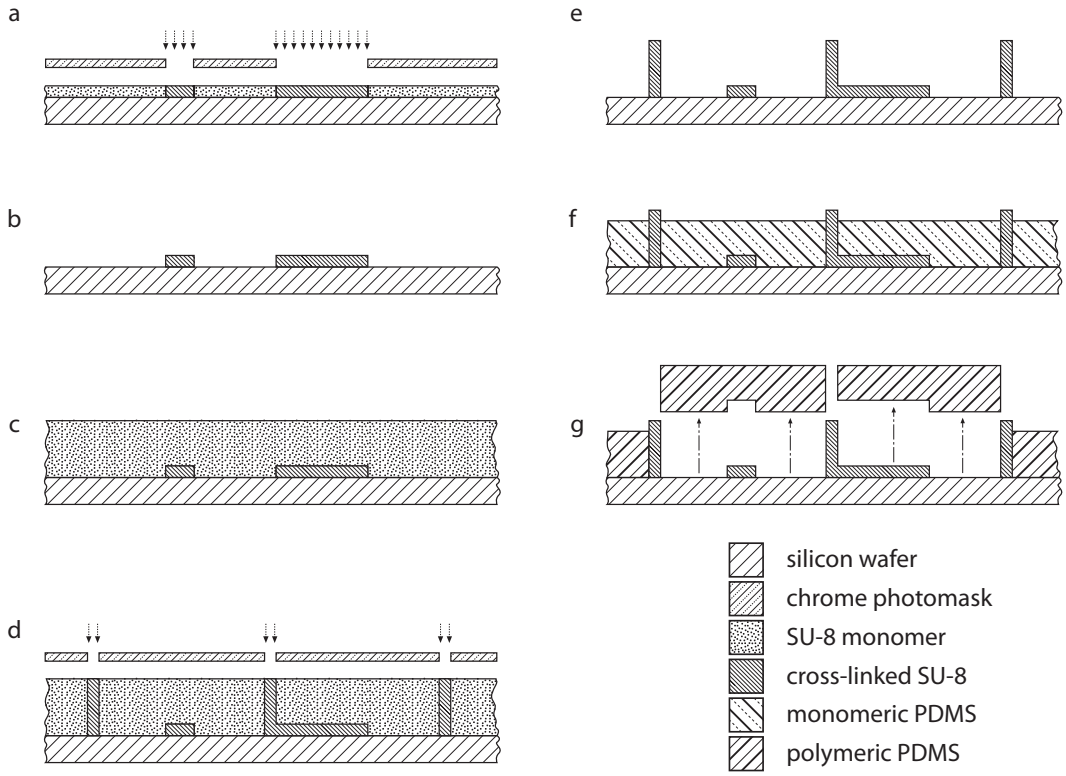


**Fig. S 2** SU-8 master mold fabrication methodology and original MAB casting technique. (a) SU-8 resist is spun onto a bare silicon wafer according to the patterns for fluidic channels and soft baked on the hot plate for 5 min at the 65C and for 20 min subsequently at the 95C. The wafer is then exposed on a contact aligner for a length of time appropriate to the resist thickness. (b) After post-exposure baking (PEB) for 3 min at the 65C and for 10 min at the 95C, the wafer is immersed and developed in fresh SU-8 developer solution. (c) The SU-8 2150 resist is spun to a desired thickness and soft baked for an appropriate length of time ($\approx$ 7 hrs for a 500 $\mu$m film. (d) The wafer then is carefully aligned to a chrome photomask patterned with the MAB walls exposed. (e) After the PEB, the wafer is submersion developed in SU-8 developer. (f) PDMS prepolymer and curing agent (9:1 or 10:1 by weight) is cast against the mold. Then, slightly tilt the mold and scratch the excessive PDMS solution off, using a razor blade. (g) Each cured PDMS block is carefully removed with a sharp aluminum needle.

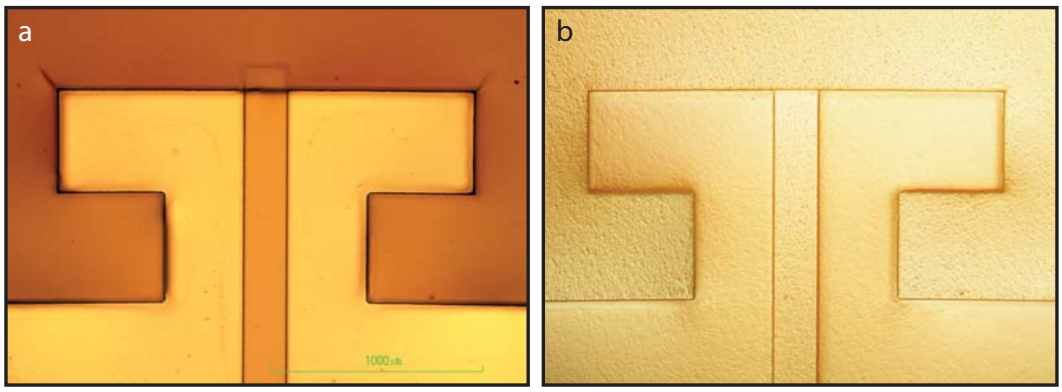


**Fig. S 3** Observed surface roughening of silicone replicates. (a) Microscope image of original SU-8 master mold following silanization treatment (20 $\mu$L trichlorosilane for 1hr under closed vacuum). (b) Microscope image of replicate mold in silicone rubber following final silanization treatment exhibiting a slightly roughened surface topology.

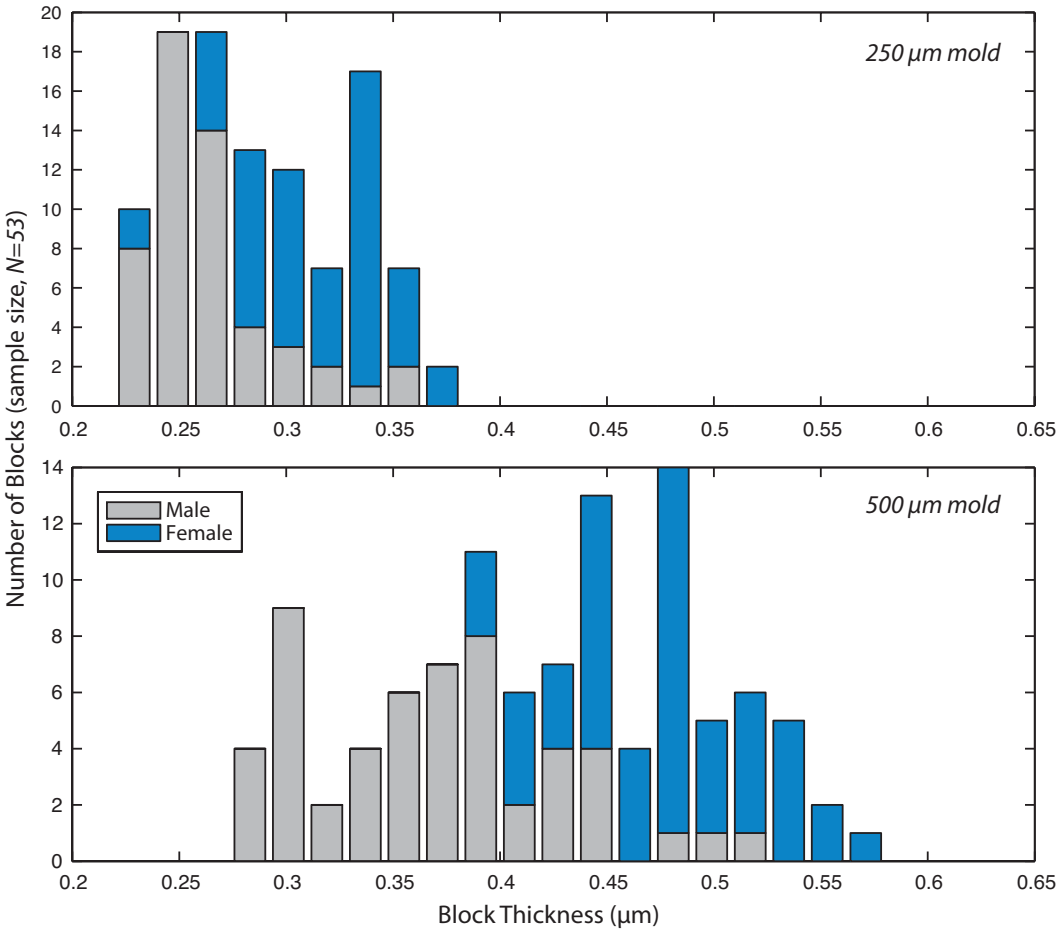


**Fig. S 4** Variations in MAB thickness. (top) Thickness distribution of male and female MABs taken from a 250 $\mu$m mold. (bottom) Thickness distribution of male and female MABs taken from a 500 $\mu$m mold.

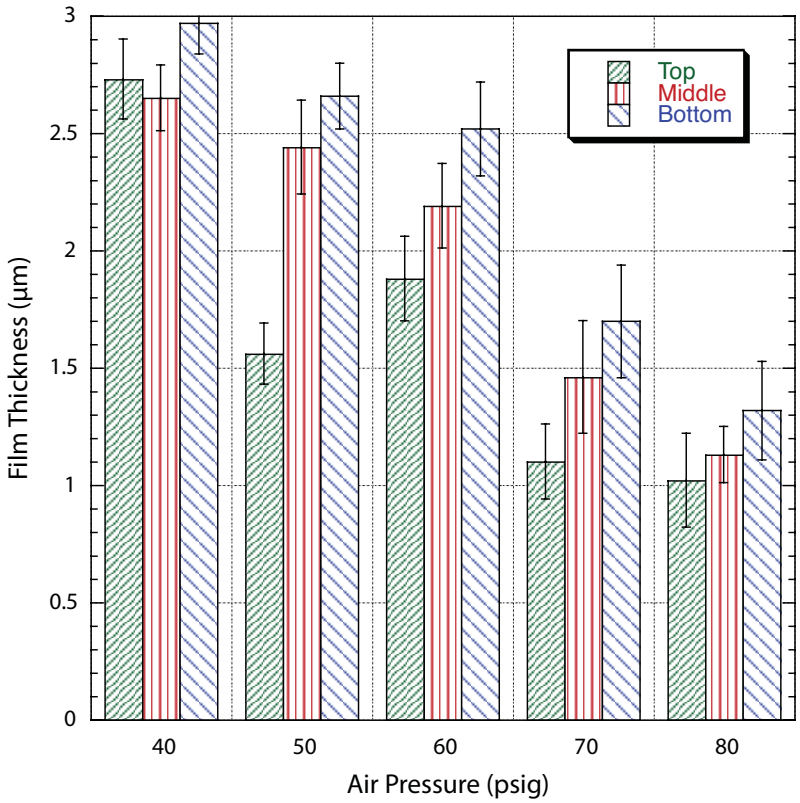


**Fig. S 5** Systematic variation in film thickness of prepared substrates. (main plot) Variation in thin-film thickness as a function of location on the substrate (top, middle, bottom). Note: *top* refers to the beginning of the air-jet path (*inset*, Figure 6b).