Microfabricated Device fabrication

1. Make sure design wafer is clean (If not, use ethanol/acetone and clean thoroughly).
2. Measure out silane using a Pasteur pipette and place in a 15 mL centrifuge tube and place in a desiccator.
3. Place design wafer from step one in a weighing boat and place in same desiccator.
4. Place under vacuum for 45 minutes to coat wafer with silane.

PDMS mixing

5. Measure out 35g Polydimethyl siloxane (PDMS) into a weighing boat.
6. Add 3.5g (10:1 ratio) curing agent.
7. Mix using scapula for 5 minutes using a circular, then back and forth motion to avoid spillage.

De-bubbling and curing

8. Remove wafer and pipette/tube from vacuum. Discard pipette/tube in sharps container.
9. Add PDMS from step 7 to weigh boat with wafer.
10. Place in desiccator under vacuum for 45 minutes or until bubbles disappear.
11. Remove from vacuum, cover with weighing boat.
12. Place in oven (60C) overnight.

Membrane fabrication

This step can be done concurrently with the above steps. This involves creating the membrane in between the side pieces of the device.

1. Measure out 7.7g PDMS into a weighing boat.
2. Add .77g curing agent and mix using step 7 above.
3. Add to 140mm diameter petri dish.
4. Place under vacuum in desiccator to remove bubbles.
5. Remove from vacuum, cover with petri dish cover.
6. Allow to sit on level surface until PDMS spreads evenly over dish surface.
7. Place in oven (60C) overnight.

Device fabrication

1. Remove wafer and petri dish from oven.
2. Remove wafer from weighing boat carefully using scalpel to separate edges of PDMS from weighing boat surface.
3. Cut around wafer to remove excess PDMS.
4. Using a razor blade, cut out rectangular side pieces following designs on wafer and **remove slowly to avoid damaging design wafer.**
5. Clean wafer.

6. Remove PDMS membrane from petri dish in same manner as design wafer.
7. Place side pieces from step 4 on PDMS membrane and cut around to form a rectangular surface around both pieces.
8. Remove side pieces.
9. Punch holes at the channel ends of design on the side pieces, punch out with tweezers.

Bonding

Make sure membrane and side pieces are clean before bonding.

1. Place side pieces design side up in plasma bonder along with membrane (attaching side up).
2. Plug in and turn on oxygen tank and AC Power on plasma bonder.
3. Push in chamber and turn on vacuum. Allow needle to reach appropriate level.
4. Turn on UV and meter, adjust level to halfway. **Make sure you are wearing UV glasses.**
5. Adjust tuning knob until UV light is brightest.
6. Turn level knob all the way to the right to begin bonding and wait for 30 seconds.
7. Turn level knob to the left to stop bonding.
8. Turn off meter, UV, and vacuum. Wait for chamber to drop before shutting off AC power and oxygen.
9. Remove side pieces and place on membrane to bond. Place on hot plate or level surface and place weights on top. Let sit overnight.
10. Cut out around attached pieces and remove, making sure membrane is attached.
11. Repeat bonding procedure for piece with membrane and piece without membrane (Will create double-sided device with one membrane in middle).

Tubing

1. Mix PDMS with curing agent (small amount, 10:1 ratio PDMS: curing agent).
2. De-bubble under vacuum, remove.
3. Shave down ends of appropriate tubing and place in each hole on both sides of device.
4. Using tweezers, use a small amount of PDMS around each hole to ‘glue’ tubing onto hole.
5. Cure using heat gun.
6. Repeat for each hole.