MICROMOLDING PDMS DEVICES

CORAL Name: --

Model Number: --

Location: ICL

What it does: This is a fabrication procedure

Introduction: --

Safety: --

Procedure: (Note that the fabrication process steps do not have to be performed in a clean room environment except the lithography step.)

Fabricating SU-8 Negative Masters:

1. Draw the masks in a CAD program (e.g. AutoCAD or Macromedia FreeHand). Make the masks accordingly (chrome mask or transparency mask – see separate SOP).
2. Follow the SU-8 SOP to make the SU-8 masters.
3. Treat the SU-8 masters with silane to prevent PDMS from sticking to the master in subsequent steps. To do so, place a vial containing a few drops of silane reagent (tridecafluoro-1,1,2,2-tetrahydro octyl trichlorosilane). Put the wafer in a petri dish, and together with the silane reagent into a vacuum chamber (there is a designated desecrator in EML). Let the silane evaporate under vacuum for at least 30-60 min. Remove the wafer and dispose the vial as chemically contaminated glass.

   If etched Si negatives are used, the same silane reagents can be applied to prevent PDMS from sticking.

Micromolding of PDMS:

1. Weigh out PDMS prepolymer and the initiator (10:1) and mix in a cup.
2. Degas the mixture under vacuum until no bubbles are visible.
3. Pour the mixture slowly into a petri dish containing the SU-8/Si master wafer. Avoid bubbles. (At this point, you can degas again if there are still bubbles.)
4. Cure the PDMS in an oven at 70 ∞C for 1-2 hours. (You may experiment with the curing time depending on the thickness of the PDMS layer, and the desired modulus of PDMS.)
5. 5. Peel off the PDMS from the master slowly and carefully. Cut the devices out with a blade.

Sealing PDMS on glass (with oxygen plasma):

1. Punch holes in the device if necessary.
2. Clean the PDMS and glass pieces with Magic Scotch Tape or with ethanol solution. Handle from now on only with tweezers and avoid the bonding surface.

   If you are Using a Harrick Plasma Cleaner (model PDC-32G, 100W, 110V) or something similar, follow steps 3-6, and skip to step 11.
3. Vent the chamber. Turn on the main power of the plasma asher, and from now on follow the guidelines of operating the asher.
4. Place the sample inside the chamber, close the chamber door, and pump down.
5. Wait until the pressure drops to 100mTorr (at the most 300 mTorr). Turn on the plasma.

6. Open the air or oxygen valve (depending on the asher setup) slightly. Watch the color change in the plasma as you bleed in the gas. The plasma should turn from pale pink (or purplish blue sometimes) to slightly darker pink (orange-pink). Sustain this color for 30 sec. Turn the plasma off, and then turn off the pump. Open the valve and wait till the chamber reaches atmosphere pressure. Open the door and take out the sample.

If you are Using the asher in EML:

7. Vent the chamber. Turn on the main power of the plasma asher, and follow the guidelines of operating the asher.
8. Place the sample inside the chamber, close the chamber door, and pump down.
9. Wait until the pressure drops to 100mTorr and turn on the plasma.
10. Open the oxygen valve. Sustain the plasma for 2 - 10 sec (this is sample-dependent so you may wish to experiment before bonding a real device). Turn off the plasma and the pump. Vent and open the chamber.
11. Seal the PDMS piece against the glass substrate. Remember not to press against the features on the device as the features sometime sack and will bond to the glass!
12. Pumping down again for the next sample, or put the asher in stand-by mode.

Author:Hang Lu (based on Rebecca Jackman's process with modifications), 12/02<hlu@mit.edu>