PDMS-PDMS Bonding Study Report – Technics

Updated on 02/28/2015

Critical factors:
- Set O_2 pressure to 2.16 Torr
- Power to 30W
- Plasma for 30s
- Wait 20 minutes before testing bond

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Goal

Test the effects of various parameters on bonding PDMS to PDMS in the Technics plasma etcher.

Materials
- PDMS spun coverslips
- PDMS microfluidic chamber
- Methanol (if alignment of surfaces is necessary)

Equipment
- Technics RIE
- Oven (for accelerated drying with methanol use)
- Laurell Spin Coater

Protocol

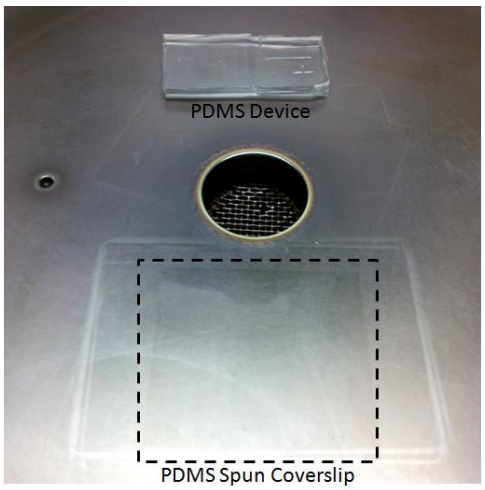
<u>Preparation of PDMS Spun Coverslips</u>

1. Plasma etch glass coverslips
    a. 5 min, 700 mTorr, 30 W
2. Mix small amount of PDMS (~ 10 g total) at 10:1 base:cure by weight
3. Degas until clear
4. Set Laurell spin parameters:
    a. Vacuum = “req”
    b. 4000 rpm
    c. Accel = “400”
    d. 2 min
5. Center coverslip on spin coater chuck

6. Deposit minimum amount of PDMS necessary to coat
    a. 25 mm X 25 mm : ~ pea size aliquot
    b. 25 mm diameter: ~ pea size aliquot
    c. 45 mm X 50 mm : ~ dime size aliquot
7. After spinning allow coverslips to sit level at RT for a few hours (2-4 hr is sufficient) to allow leveling
8. Bake coverslips
    a. If placing spun coverslips in plastic petri dishes, bake at a moderate temperature of (e.g. ~ 65C) overnight to prevent melting the dish
    b. If placing spun coverslips in a metal or glass container bake at higher temperatures for shorter period of time (e.g. 90C, 1 hr)

<u>Bonding PDMS Microfluidic Device to PDMS Spun Coverslip</u>

1. Run a blank plasma etch cycle (no samples loaded in reaction chamber) to establish power supply setting
    a. 700 mTorr, 30W
2. Vent reaction chamber and load samples with contact faces oriented upwards towards chamber ceiling.
    a. The positions used for this validation study were as follows:



3. Treat surfaces for 7-15 sec
4. Vent reaction chamber
    a. If no fine alignment is necessary:
        i. Immediately place bonding face of microfluidic device into contact with the spun PDMS coverslip by gently setting the device on the coverslip
        ii. Use as little pressure as necessary to spread the contact interface
        iii. When the contact interface is uniformly spread manually apply moderate and uniform pressure for 15 sec
        iv. Allow unweighted surfaces to incubate 20 min before performing a peel test. A peel test performed before 20 min incubation will result in permanent failure of the bond.
    b. If fine alignment is necessary:

i. Transfer components to solvent chemical hood and apply the least amount of methanol necessary to coat the two substrates
ii. Slide device(s) until properly aligned
iii. Apply uniform and persistent pressure to ensure exclusion of excess methanol and contact of surfaces during methanol drying (do we need a note about clamping?)
iv. Allow methanol to evaporate for 2 hr at RT. Accelerated drying can be achieved by placing weighted device into 80C oven.

c. Excessive pressure at any stage will cause permanent warping of your substrate after the PDMS:PDMS bond is formed

Results

Plasma Duration @ 700 mTorr, 30 W	Contact Duration	Contact Temperature	MeOH for Alignment	Weighted Contact	Peel Test Outcome
sec	min	deg C	y/n	y/n	Pass/Fail
7	20	21	no	no	Pass
15	20	21	no	no	Pass
30	20	21	no	no	Fail
15	120	21	no	no	Pass
15	120	21	yes	no	Fail
15	120	80	no	no	Pass
15	120	80	yes	no	Fail