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Microfluidics 4: PDMS Chip Soft Lithography V.4

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Microfluidics materials are of various types and application-specific. PDMS is one of the most preferred and cost-effective solutions for research and low-volume manufacturing. After having the mold, PDMS replicas are generated by a technique called soft-lithography. This protocol describes the preparation of PDMS microchannels using SU8 molds, 3D Printed resin molds, and/or metal molds by the soft lithography technique, SLA printing, or CNC machining.

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PDMS material; Dow Corning, Sylgard 184

* All the related steps must be done in a clean room classD (minimum).

* Please learn well about the hazards of Sylgard 184 chemicals.

This protocol is also called "soft lithography" in the literature the reference protocol is taken from the manual of Sylgard 184 silicone elastomer, Dow-Corning.

Mixing Components of PDMS

10m

1 1.0.1. PDMS constituents are mixed in 10:1; Sylgard184 monomer : Hardening agent

1m

Centrifuge

Sigma s

Vacuum

Vacuum Chamber with Vacuum Pump V

Weighing machine

BEL Engineering LW423i - IT1502888



This step is performed inside class2 laminar flow hood cabinet

1.1 1.1.1. Switch on weighing machine power.

1m

1.1.2. Place an empty 50 mL tube on the weighing machine and tare the balance.

1.1.3. Pour the Sylgard184 monomer inside a 50mL tube and make it 10gr or multiples of it.

1.1.4. Pour the Hardening Agent on Sylgard184 monomer and make the weight added 1.0 gr of the first one. So the final weight ratio for both will be 10:1.

1.2 **1.2.1.** Components are mixed well in a tube or beaker using a glass stick. ^{3m}

1.2.2. The time duration required to perform the physical mixing of the Sylgard184 components must be minimum 3 minutes for 50mL tube and it can be prolonged until being sure about complete mixing.

1.2.3. Hard mixing of ingredients causes air bubbles inside which may disappear as late as an hour.

1.3 **1.3.1.** In order to remove air bubbles quickly there are two main options; ^{5m}

1.3.2. The mixture is centrifuged at 500g for 5 minute.

1.3.3. The mixture is exposed to a vacuum inside the chamber.

PDMS on mold 3h 36m

2 **2.0.1.** Pour the mixture into the mold. ^{1m}

Hot Plate

Electromag LB.EM.M4060

Heater Oven

Heater Oven 30-100C

2.1 **2.1.1.** Pour the mixture into the molds which could be the SU8 mold, 3D ^{35m}
printed mold, or metal mold, those are put inside a petri plate and leave it for
around 30 minutes at room temperature.

2.1.2. Leaving for 30 minutes at RT is necessary when air bubbles are showed
up during the pouring.

2.1.3. When there are air bubbles remaining in the material, place the PDMS poured mold inside vacuum chamber for degassing for 5 minutes.

2.2 **2.2.1.** Heating of the PDMS in the mold has alternative options. 3h

2.2.2. If the mold is SU8 on a Silicon wafer then, PDMS is heated at 65°C for 2-3 hours on a heater plate device.

2.2.3. If the mold is 3D printed resin or metal then, PDMS is heated at 85°C for 3 hours inside a heated oven.



The bottom of the heater plater or heater oven must be even for not to cause defects of uneven thickness on PDMS.

Stock of PDMS 1w

3 **3.0.1.** The excess of mixed PDMS (but not heated) can be stored in a refrigerator (+4°C) for^{1w} up to one week.

3.0.2. Just take from the refrigerator and pour on a new mold and incubate.



A longer duration for storage is not suggested since PDMS can polymerase longer even at lower temperatures.

Demolding of Cured PDMS 11m

4 **4.0.1.** After completion of the curing time of PDMS on mold, the PDMS gel is removed^{10m} carefully away from the mold.

4.0.2. Being gentle is important at this step not to form defects on the PDMS layer.

4.0.3. The PDMS layer is put inside a clean petri dish or clean plastic surface.



This step is performed inside the class2 laminar flow hood cabinet.

4.1 **4.1.1.** Visual check of PDMS layer is performed under a digital microscope,^{1m}



and these parameters are checked mainly;

- Debris (Trace), air bubbles (active areas), Stains-Voids, Scratch marks, Broken PDMS, Uneven PDMS, Wrong Orientation (PDMS)