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Microfluidics 4: PDMS Chip Soft Lithography V.3

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ABSTRACT

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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KEYWORDS

microfluidics, pdms

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MATERIALS TEXT

PDMS material; Dow Corning, Sylgard 184

SAFETY WARNINGS

- * All the related steps must be done in a clean room classD (minimum).
- * Please learn well about the hazards of Sylgard 184 chemicals.

REFORE STARTING

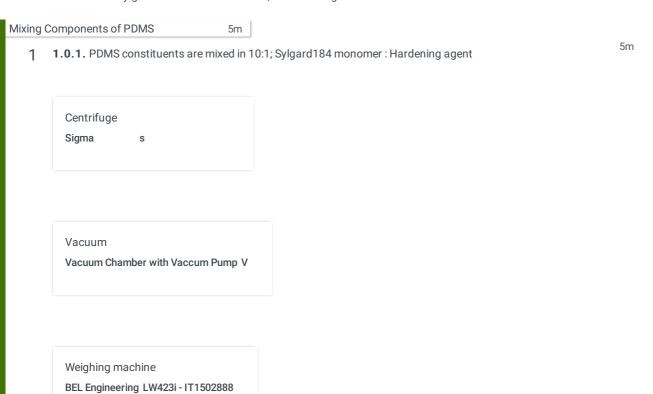
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This protocol is also called "soft lithography" in the literature the reference protocol is taken from the manual of Sylgard 184 silicone elastomer, Dow-Corning.



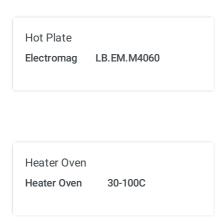
A

This step is performed inside class2 laminar flow hood cabinet

- 1.1 1.1.1. Switch on weighing machine power.
 - 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 0.1 gr of the first one. So the final weight ratio for both will be 10:1.
- 1.2.1. Components are mixed well in a tube or beaker using a glass stick.
 - **1.2.2.** Hard mixing of ingredients causes air bubbles inside which may disappear for more than an hour.
- 1.3 1.3.1. In order to remove air bubbles quickly there are two main options;
 - 1.3.2. The mixture is centrifuged at 500g for 1 minute.
 - 1.3.3. The mixture is exposed to a vacuum inside the chamber.

3h 30m

2.0.1. Pour the mixture into the mold.



- 2.1 2.1.1. Pour the mixture into the molds which could be the SU8 mold, 3D 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. If there are no air bubbles then advance directly.
 - 2.1.3. If there are air bubbles reply to vacuum chamber degassing on PDMS poured mold.
- 2.2 2.2.1. Heating of the PDMS in the mold has alternative options.
 - **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.



Stock of PDMS 1w

3.0.1. The excess of mixed PDMS (but not heated) can be stored in a refrigerator (+4°C) for 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 10m

4.0.1. After completion of the curing time of PDMS on mold, the PDMS gel is removed 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.

- **4.1.1.** Visual check of PDMS layer is performed under a digital microscope, and these parameters are checked mainly;
 - Debris (Trace), air bubbles (active areas), Stains-Voids, Scratch marks, Broken PDMS, Uneven PDMS, Wrong Orientation (PDMS)