

PDMS Mold Preparation Procedures

PDMS preparation is done using the Sylgard 184 Silicone Elastomer Kit. All MSDS and chemical properties information along with further instructions for using the product can be obtained from the manufacturer, Dow Corning's website:

(<http://www.dowcorning.com/applications/search/default.aspx?R=131EN>).

1. Pre-heat oven to approximately 100 degrees.

- a. We use a small Corning vacuum oven without a precise temperature scale and only a dial setting which is set to between 3 and 4.

2. Mix the elastomer with the curing agent.

- a. Measure out a desired amount of elastomer into a clean graduated tube.
- b. Wait for all the highly viscous elastomer to settle at the bottom of the tube in order to measure the amount obtained.
- c. The elastomer and curing agent will be mixed at a 10 parts to 1 part ratio (10:1). Determine $1/10^{\text{th}}$ measurement of the amount of elastomer used and set a pipette measurement scale to obtain that amount of curing agent.
- d. Add the curing agent to the elastomer and gently pipette in and out small amounts in order to mix the two together. Stirring the mixture with the pipette tip is also fine since the mixture might be too viscous for use of a pipette.

BE CAREFUL not to pipette the mixture up through the pipette tip and into the pipette chamber itself since it will alter future suction function of the pipette by drying and clogging it. If this happens, disassemble the pipette and use a small amount of acetone in the pipette chamber to help remove pieces of dried PDMS.

- e. Thoroughly mix the elastomer with the curing agent for a few minutes and then set the tube down for about a half hour, or until almost all the bubbles disappear from the solution.

3. Apply PDMS to the mold.

- a. Once almost all the bubbles have cleared from the mixture (now we will refer to the mixture as PDMS), use a pipette to get small amount and carefully coat the desired cavities of the sample mold.
- b. Apply the highly viscous PDMS to the sample mold a bit like how you would apply frosting to a cake. Let the PDMS run slowly off the pipette tip and move it back and forth over the coverage area.

TRY NOT to have any bubbles in the PDMS within the mold because the bubbles will solidify in the baked sample. Remove bubbles carefully by suctioning them out with a pipette.

- c. Also apply PDMS to some other "test mold" which you can poke at later in the oven to determine if both samples have finished baking.
- d. Fill both molds to the top of the cavity so that there is an even surface.

4. Bake PDMS in the oven.

- a. Carefully place the PDMS mold and test mold into the oven. A flat paper or aluminum foil layer placed underneath the molds is a good idea just in case the PDMS overflows and sticks to the oven surface.
- b. Let the samples bake for approximately 10-15 minutes, then check on the test mold by poking it with a toothpick. If it is solid then take both samples out, but if it is still slightly liquid the leave in for a few more minutes.

NOTE: The Dow Corning website listed above has the following heat cure specifications which differ slightly from how we bake our PDMS samples:

Heat Cure 10 Minutes @ 150 Deg C

Heat Cure 20 Minutes @ 125 Deg C

Heat Cure 45 Minutes @ 100 Deg C

Tailor your baking time to how your oven works and check on the PDMS samples continuously to be sure that bubbles in the PDMS are not rising or expanding if baking at too high a temperature. If this happens, the bubbles can dry in the PDMS mold and leave a hole in your PDMS mold. PDMS can dry on its own in about 24 hours at room temperature, so baking it at lower temperatures for a longer amount of time might be the best way to ensure that any tiny bubbles in the PDMS do not expand when baking at too high a temperature.

- c. Remove fully cured PDMS samples from the oven and put them in a freezer for a few minutes. This will shrink the PDMS slightly and will help when peeling the samples delicately out of their molds.
- d. Careful use of a scalpel blade can separate the PDMS from a side of the mold wall so that the rest can be pulled gently from the mold.

Mike Frank
MEMS Research Lab
Department of Mechanical Engineering
San Diego State University
E-mail: michaelbfrank@gmail.com