CREATING PDMS MOLDS WITH SU8 PHOTORESIST SOP

UNIVERSITY OF LOUISVILLE
Micro/Nano Technology Center

October 2013

Introduction

The goal of this SOP is to provide instructions for generating custom molds of any thickness for use with PDMS. We are using SU8 for these molds because of the great variety in available thicknesses and its firmness once it has been cured. There are many types of SU8 available, but this SOP will only cover the use of SU8 from the 2000 series. For other types of SU8 some modifications may be necessary to get the best results.

SU8 comes in a variety of thicknesses and what type to use depends on the current application. Ideally, an SU8 is available that matches the goal thickness of the mold in which case it should be used. In other cases it is also possible to apply multiple layers constructively by repeating the spinning and soft bake procedures. If this is necessary, thicker photoresists should be applied before thinner resists.

Procedure:

Dehydration

1. Set the temperatures for three hotplates to 65°C, 95°C, and 115°C.

2. Remove the desired photoresist from the refrigerator and let it warm up to room temperature before opening.

3. Take a bare Silicon wafer and clean it. Leave it on the 115°C hotplate for 3 minutes to ensure the wafer is dehydrated before spinning resist. If adhesion is a problem, higher temperatures here (around 150°C) can yield better results.

4. Make sure the wafer is cooled and the Photoresist is room temperature before spinning.

Spinning

1. Adjust the settings on the spinner bench to:

SPREAD: Ramp - 100 RPM/sec, Speed - 500 RPM, 0 sec

SPIN: Ramp - 500 RPM/sec, Speed - 3000 RPM, 30 sec

2. Dispense about a 4 cm diameter blob of your chosen SU8 onto the center of your Silicon wafer (rotate the wafer to ensure the blob is centered).

3. Center the wafer on the spinner chuck and run the spinner.

Soft Bake

1. Remove the wafer from the spinner and use acetone if necessary to remove any SU8 from the bottom of the wafer

2. Place the wafer on the 65°C hotplate for the time outlined in the chart below

3. Transfer the wafer to the 95°C hotplate for at least the time outlined in the chart below

4. Actual bake time can depend on the age of the SU8 among other variables, so to ensure that baking is finished take the wafer off the hotplate for a minute and tap the corner of the wafer with tweezers. If the SU8 is still sticky, it needs further baking so briefly return to the 65°C and transfer to the 95°C hotplate again.

NOTE: Ensure that the wafer is cooled to roughly room temperature before progressing to exposure

Thickness (microns)	Soft Bake Time (minutes @ 65C and 95C)
0.5 - 2	1
3 - 5	2
6 - 15	2 - 3
16 - 25	3 - 4
26 - 40	4 - 5

Exposure

1. Expose the photoresist based on the information from the following chart.

NOTE: at the time of this writing, the Suss Aligner exposed at about 160 mJ/cm^2 in 60 seconds.

Thickness (microns)	Exposure Energy (mJ/cm2)
0.5 - 2	60 - 80
3 - 5	90 - 105
6 - 15	110 - 140
16 - 25	140 - 150
26 - 40	150 - 160

Post-Exposure Bake

1. For SU8, a post exposure bake is necessary for development to function properly.

2. Place the wafer on the 65°C hotplate for the time outlined in the chart below.

3. Transfer the wafer to the 95°C hotplate for at least the time outlined in the chart below.

4. The image of the exposure should be clearly visible in the photoresist at this time.

NOTE: Ensure the wafer is cooled to room temperature before moving to the next step.

Thickness (microns)	Post-Exposure Bake Time (minutes at 95C)
0.5 - 2	1 - 2
3 - 5	2 - 3
6 - 15	3 - 4
16 - 25	4 - 5
26 - 40	5 - 6

Development

1. Fill up an appropriately sized pan with enough PGMEA (aka BTS 220) to keep the wafer submerged.

2. Follow the chart below for an estimate of appropriate development times, agitating sparingly.

3. When done with development rinse the wafer with Isopropanol or the squeeze bottle of SU8 developer

4. Thoroughly dry the wafer before proceeding to hard bake.

Thickness (microns)	Development Time (minutes)
0.5 - 2	1
3 - 5	1
6 - 15	2 - 3
16 - 25	3 - 4
26 - 40	4 - 5

Hard Bake

1. Place the wafer on the 115°C hotplate for 5 minutes at minimum, longer for thicker resists. If thermal processing with mold is anticipated, make sure to hard bake at least 10°C higher than the anticipated processing temperature.

2. The Hard Bake process is designed to strengthen features and remove cracks that may have formed on the surface of the SU8.