

## **SUEX (100, 200 and 500 microns thick) on Si wafers**

*The process is the same for casting SUEX on acrylic. No preparation of the acrylic is needed other than removing the protective films and using spacers during lamination if the acrylic is thicker than 500 um.*

- 1. PREPARE WAFERS.** Use new wafers from a recently opened box.
  - a. (OPTIONAL) Cleaning: clean wafer in Hamatech Hot Piranha.
  - b. (REQUIRED) Dehydration: 90°C oven overnight, or 160°C hot plate > 20 min.
  - c. (OPTIONAL) Oxygen plasma in Oxford 81/82 for 30s for improved adhesion.
  
- 2. LAMINATE.** Turn the laminator ON with rollers rolling at least 10 min beforehand. Wipe the rollers with an acetone-wetted ALPHA wipe; not a beta wipe.
  - a. Place the wafer on the aluminum square and cover with a PET separator sheet. Spacers (500 micron) are recommended for SUEX thicker than 100 um.
  - b. Remove the shiny PET from the SUEX. Place SUEX side-down on separator sheet.
  - c. Align SUEX chip and press gently at 12:00 on the wafer for 15 sec to adhere.
  - d. Laminate: SUEX 100, 200: 65°C (actual temp) at 1 ft/min roll rate.  
SUEX 500: 70-75°C (actual temp) at 1 ft/min roll rate.
  
- 3. POST-LAMINATION BAKE.** To relax the SUEX & remove trapped air and defects.
  - a. Keep the hazy PET coversheet on.
  - b. Place the wafer on a piece of aluminum foil in the PDMS casting OVEN
  - c. Bake 65°C for 15-20 min. ***You can store chips for weeks after this step.***
  
- 4. EXPOSE.** REMOVE THE HAZY PET FROM THE SUEX BEFORE EXPOSING.
  - a. Use 365LP filter. The dose on the ABM aligner is about 8 mJ/cm<sup>2</sup>.
  - b. Expose in 30-sec intervals with 15 to 30-sec rests.
    - 100 SUEX: 1200-1400 mJ/cm<sup>2</sup>
    - 200 SUEX: 1600-1800 mJ/cm<sup>2</sup>
    - 500 SUEX: 3400-3600 mJ/cm<sup>2</sup> (Yes, this is over 425 seconds!)
  
- 5. POST-EXPOSURE BAKE.** Immediately following exposure. 2 ramping steps on hot plates.
  - a. Ramp from room temperature → 65°C; then bake 5 min.
  - b. Ramp to 95°C. Bake 10 min (100 SUEX); 15 min (200 SUEX) or 20 min (500 SUEX).
  - c. Ramp down to room temperature. (Turn off hot plate and wait 1 hr.)

6. **DEVELOP.** Face down in PGMEA (EBR-10A). Slow stirring may detach features.
  - a. Immerse for 20-30 min. Fresh bath (OPTIONAL) 5-10 min.
  - b. Rinse in isopropanol for 5 min and dry thoroughly.
  
7. **HARD-BAKE.** To remove residual developer and improve adhesion. SUEX will discolor at 110-120 °C; it will turn to dark red at 180 °C.
  - a. Hot plate option: 95°C for 15 min; then ramp to room temperature.
  - b. Oven option: 90-110 °C for 2-4 hr. Any regular oven will do.

<b>TROUBLESHOOTING</b>
------------------------

**Poor adhesion.**

- wafer not dehydrated – remove native oxide layer and bake dry thoroughly
- SUEX not laminated well – use recommended values
- under-exposed – increase the dose. Be sure you're using the correct listed output. The ABM with the 365 LP filter is the value for 405 and 365 mirrors with the filter (bottom right value on the sticky note.)
- too much agitation of small features during development – don't stir unless necessary.

**Thickness is short of the expected height. Expect SUEX to be at least 4% shorter than stated.**

- Lamination conditions are too harsh. You may notice that the SUEX is oozing from the hazy PET covering and sticking to the cover sheet on the aluminum square.
  - Use the settings for temperature that are listed on the laminator. They are much lower than the actual temperature.
  - Let the laminator equilibrate with rollers turning for 10 minutes.
  - Use 500-micron spacers for every 500 microns of substrate + SUEX thickness
- Batch variation straight from the manufacturer.
  - Lots of 200 SUEX have ranged as low as 180 um straight from the manufacturer.
  - Lots of 500 SUEX are typically at 480 um following this protocol.

### Discoloration.

- The photoinitiator that is in the SU-8 begins to turn yellow around 110 °C and turns dark red at 180 - 200°C.
  - Hard-bake for several hours at 100 °C or lower; preferably in an oven.

### Surfaces of features are rough or 'pebbly'.

- It's a characteristic of the material. -SU-8 is a hybrid of SU-8 and a proprietary polymer.