1 Objective:

This Standard Operation Procedure states how properly handle chemicals in the CIBA clean room/Chemistry lab/ESP nano fab lab.

2 Responsibilities:

2.1 Director / HOD / PI

The Director/HOD/PI has overall responsibility for ensuring a chemical process is designed for safe lab practices.

2.2 Designated Person

There shall be a designated person to oversee the correct procedures.

2.3 Staff/ Research personnel

a. Users shall attend appropriate training on the safe use of chemicals in the ESP nano fab lab.
b. Users shall report any injuries, defects or breakdowns to their supervisor.

3 General Instructions

Common procedures on handling of chemical, e.g. refill of wash bottle (IPA, Acetone); transferring chemical from storage cabinet to the fume hood; Disposal of waste chemicals.

1) Wear gloves, mask, and proper PPE when working with chemicals
2) Wash bottles refill in fume hood that located in Chemical room.
3) Emergency chemical spill kits are placed in CIBA main lab (S7-01-01) and Chemitry lab(S7-01-09)
4) Special Bins for broken glassware and sharp things are available at all the three labs.
5) Sample development, etching and Waste disposal is done in a fully closed fume hood, the danger is reduced to minimum.

4. Developing the laser writer blanks in ESP lab (only AZ developer and Cr etchant are allowed in ESP lab apart from IPA and Acetone)

- Ensure that the gloves are dry (and clean) when inserting them into the chemical box!
- All photosensitive chemicals are to be handled within the yellow light section (all developer and etchant solutions)!
- Developer solutions (AZ), Cr Etchant and Acetone should only be exposed to air within the chemical flow box to prevent exposure to volatile fumes!
- Use only the wafer tweezers to handle the mask!
- Immersion time in solutions need to be timed exactly. Use a timer!
- Compressed air is obtained from the air gun. Keep the gun triggered when adjusting the pressure, and beware of the initial spurt of high pressure air when it’s initially triggered!

- All utensils must be cleaned with DI water after use.
- Replenish DI water from the CIBA Clean Room.

Mask Development

1) Dilute the AZ developer with DI water at a ratio of 1:4 (AZ Developer: DI water).
2) Pour the diluted AZ developer solution into a Petri dish and prepare another Petri dish that is filled with DI water.
3) Immerse the mask into the AZ developer solution for 1 min while agitating the solution constantly, then rinse off the AZ developer solution on the mask in the Petri dish filled with DI water.
4) Dry the mask using compressed air until there are no more water droplets left.

Mask Etching

1) Prepare undiluted Cr etchant, DI water and acetone.
2) Immerse the mask into the Cr etchant solution for sufficient time (~ 2 min) while agitating the solution constantly, and then rinse off with DI and acetone in sequence.
3) Dry the mask using compressed air until there are no more water droplets left.

5. Other commonly carried out processes

A. Spin Coating (Clean room and Chemistry lab)

1) Once the Si wafer is loaded and the spin coater is programmed, the photoresist is carefully poured onto the centre of wafer (to avoid bubbling) until it covers 1/3 of the area before commencing the spin-up process.

B. All Resist Development should be carried out in Chemical room & Cleanroom.
Only AZ development and Cr etching are allowed in ESP lab

SU-8 Development (Example)

1) Prepare undiluted SU-8 developer solution and DI water in separate Petri dishes or beakers.
2) Immerse post baked SU-8 into the SU-8 developer solution for at least 2 min, then rinse thoroughly with IPA and dry using compressed air. Thicker SU-8 samples require longer development time. Consult the Microchem website for the desired development times.
3) If additional cleaning is needed, immersion followed by slow and careful withdrawal from IPA and then DI water should be carried out.

C. PDMS Casting (ESP lab)

1) Using double-sided tape, stick the SU-8 on Si wafer to the base of a fresh plastic container (exposed side facing up) while making sure that there are no air bubbles trapped within the double-sided tape. Use the large container if the substrate could not fit in the smaller one.

2) Prepare
   PDMS by thoroughly mixing its prepolymers, the base and the curing agent together at a ratio o f 10:1 (base: curing agent) in a separate large plastic container.
3) Depending on the container size, use 8 g of base and 0.8 g of curing agent (large container) or 4 g base and 0.4 g curing agent (small container).
4) Pour the PDMS over the SU-8 substrate.
5) Place the container containing the SU-8 substrate into the vacuum desiccators and evacuate the desiccator chamber for about 15 min. Once evacuation begins, open the air valve at the top of the chamber slightly to slow down the evacuation rate. Foaming will be observed on the PDMS.
6) Once the time is up, close the valve and close the vacuum valve. Then slowly open the air valve and wait for pressure equalisation in the chamber. Once the pressure has equalised the plastic container can be removed. Degassing is repeated if deemed necessary.
7) Transfer the PDMS cast into an oven for curing at 80 °C for at least 6 hr. Samples can be baked for longer periods at 65 °C.
8) Post-curing, use a fresh blade to make vertical cuts into the PDMS ~0.65 cm from the mould edge, angle it at 30° to the vertical and drag it along a side of the master mould. Repeat on all sides till the master mould and cast can be removed from the excess PDMS.
9) Slowly peel the PDMS cast from the SU-8 mould until both halves are free from each other.