



# Lab Manual

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## ***Photomask Cleaning*** (sink12 Photomask Cleaning Station)

### **1.0 Title**

Photomask Cleaning

### **2.0 Purpose**

This station (sink12 in R1) provides the means for cleaning chrome, emulsion, and iron oxide photomasks.

### **3.0 Scope**

This document describes the procedure for manually/automatically cleaning masks with CA-40 photomask cleaning solution. There are also instructions for cleaning masks in solvent or piranha (chrome masks only), if/when CA-40 mask cleaning solution can not remove contamination from the mask.

### **4.0 Applicable Documents**

There are soft and hard copies of the aptemul, aptchrome and spin dryer manuals available on-line and in the equipment manual binders.

#### Revision History

4.1 Refer to [Chapter 3.4](#) for aptemul operation.

4.2 Refer to [Chapter 3.5](#) for aptchrome operation.

### **5.0 Definitions & Process Terminology**

Cyantek CA-40: Photomask Cleaning Solution used for cleaning all types of masks; it contains sodium hydroxide.

### **6.0 Safety**

6.1 Face shields, aprons, and chemical-resistant gloves must be worn at all times when working with chemicals and/or rinsing empty chemical bottles.

6.2 Water jackets should be used for heating up acid/solvent solutions, as per defined maximum allowable temperature (below flash point) in their pertinent material safety data sheets.

### **7.0 Statistical/Process Data**

N/A

### **8.0 Available Process, Gases, Process Notes**

#### **8.1 Sink 12 General Information**

8.1.1 Cyantek Corporation CA-40 Photomask Cleaning Solution shall be used to clean all types of masks at sink12 station.

8.1.2 Cleaning chrome or iron oxide masks with acetone, followed by methanol is an option.

8.1.3 Cleaning chrome with piranha is another option in specific sinks in the lab, which will be discussed later.

**Note:** *Under no circumstances photomasks to be cleaned in the hot sulfuric acid bath at sink6 or Sink8 in the VLSI area!*

8.1.4 All water available above the deck of sink12 is ultra-pure DI water. This sink consists of a fixed sink, a gooseneck faucet, a DI water deck hose, and an N2 gun. There is a large work surface area at this sink.

## 8.2 Process Notes

8.2.1 Mask cleaning with the Cyantek CA-40 Photomask Cleaning Solution shall be performed at sink12 only. This solution is available in squirt bottle at sink 12. The full bottle of this solution is stored in the 2nd C-locker from the door in R1; it is the red room chemical storage locker.

8.2.2 Always keep masks wet during the mask clean process. When a mask is dry during the cleaning step, it can easily be scratched by the foam swab and handling.

8.2.3 Blow dry the mask immediately after cleaning to avoid water marks.

## 9.0 Equipment Operation

### 9.1 Manual Mask Cleaning

9.1.1 Wet the mask you want to clean with the deck hose at sink12 in R1.

9.1.2 Squirt CA-40 mask cleaner solution on the backside of the mask, first.

9.1.3 Use one of the Texwipe foam swabs, which are kept in the white Teflon beakers at the sink to gently scrub the backside of the mask, and the affected areas.

9.1.4 DI rinse the backside of the mask with the deck hose, then turn the mask over to the front side.

9.1.4 Squirt CA-40 mask cleaner solution this time on the front side of the mask and repeat the same Texwipe foam cleaning steps, as described earlier. Make sure the mask is scrubbed in all directions to ensure proper cleaning of all features on the front (chrome) side of the mask.

9.1.5 DI rinse the front and back side of the mask thoroughly, before drying it with N2 gun mounted at the pattern generator in R2.

9.1.6 Inspect the mask either visually or at the Leitz microscope in R2. Repeat above steps, if necessary.

**Note:** If after the second round of cleaning, there is still contamination (resist) on your plate, then you may want to try soaking the plate in acetone, Option A, and as a last resort, Option B described in the following sections.

### 9.2 Automated mask cleaning (requires the aptchrome and/or aptemul qualification)

**Note:** Mask chucks on aptchrome and aptemul machines are engineered to best fit specific mask type/s. Therefore, when cleaning iron oxide or chrome mask/s, use aptchrome and when cleaning an emulsion mask, use the aptemul machine.

9.2.1 Enable proper tool for your specific mask type.

9.2.2 Turn on the power on the equipment, if it is not on.

9.2.3 Open the door and load the mask as per follows.

9.2.4 Load the mask backside up with four corners of the mask corresponding to the four corners of the mask chuck and according to the size of the mask. Move the mask around to make sure the mask is sitting in the slot correctly.

9.2.5 Wet the mask with the water deck hose in R1 at sink12; it will reach both APTs.

- 9.2.6 Squirt CA-40 mask cleaner on the backside of the mask.
  - 9.2.7 Use one if the Texwipe foam swabs, which are kept in the white Teflon beakers at the sink to gently scrub the backside of the mask and the affected areas.
  - 9.2.8 DI rinse the backside of the mask well with the deck hose
  - 9.2.9 Turn the mask over to the front side (up) and make sure the mask is seated correctly on the chuck.
  - 9.2.10 Squirt CA-40 mask cleaner solution on the front side of the mask and repeat the same Texwipe foam cleaning steps, as described earlier. Make sure the mask is scrubbed in all directions (turn the chuck and scrub, if necessary). Add more solution and repeat the scrub, if necessary.
  - 9.2.11 Run program 93 on the aptchrome or aptemul to rinse and dry the mask.
  - 9.2.12 After the rinse dry steps are completed, open the door and remove the mask.
  - 9.2.13 N2 dry the mask further, if necessary using the N2 gun mounted at the pattern generator station in R2.
  - 9.2.14 Inspect the mask either visually or at the Leitz microscope in R2. Repeat above steps, if necessary.
- Note:** If after the second round of cleaning, there are still contamination (resist) on your plate, then you may want to try soaking it in acetone (Option A), and as a last resort, Option B described in the following sections

### 9.3 Option A - Solvent clean chrome or iron oxide masks mask (acetone dip)

- 9.3.1 Pour enough acetone to cover a mask in the white rectangular cleaner dish at sink12.
- 9.3.2 Soak chrome or iron oxide mask for 5 minutes in the solution.
- 9.3.3 Scrub the front and back of the mask with texwipe foam swabs available at the station.
- 9.3.4 Rinse the mask with methanol to eliminate possibility of unwanted film left behind buy the acetone treatment.
- 9.3.5 N2 dry the mask using the N2 gun mounted at pattern generator in R2.
- 9.3.6 Inspect the mask either visually or at the Leitz microscope in R2. Repeat above steps, if necessary.
- 9.3.7 If still issues, you may opt to give it a piranha clean (Option B), as a last resort.

### 9.4 Option B - Piranha clean of chrome masks

- 9.4.1 Chrome masks (only) can be cleaned in 432A general acid sink or sink7 left heated bath with piranha acid solution.

**Note:** DO NOT USE PIRANHA BATH AT SINK6 OR SINK8 FOR MASK CLEANING.

- 9.4.2 Pour enough sulfuric acid to be able to completely submerge your mask laying down flat on its back.

**Note:** Sulfuric acid in sink7 can be heated to 120°C for optimum result.

Sink432A does not provide automatic heating/control, therefore, acid needs to be heated up in a glass or quartz container placed into another glass or quartz container with water in it, to prevent excessive heating of the acid solution (water jacket to control the acid temperature, hence preventing fire). Keep the water temperature below the water boiling temperature, preferably at or below 80°C.

**Never leave heated solution at sink432A unattended.**

- 9.4.3 Add small amount of H<sub>2</sub>O<sub>2</sub> to sulfuric to spike the solution, for a 1000 ml of sulfuric acid, you can start with 20 ml of H<sub>2</sub>O<sub>2</sub> poured into it.
- 9.4.4 Gently place your mask in the solution by using a 10" long fluoroware tweezer or other means of safe delivery of mask into the solution.
- 9.4.5 Leave the mask in the solution completely submerged for 5 minutes, while occasionally adding enough hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) to properly spike the solution for optimum cleaning results,
- 9.4.6 Remove the mask from piranha, rinse well with DI water (SRD) to ensure all acid is washed away from the sample.
- 9.4.7 Use the N<sub>2</sub> gun at the station to dry up the mask.
- 9.4.8 Inspect the mask either visually or at the Leitz microscope in R2.
- 9.4.9 If still issues, contact staff for further advice.

### **9.5 Clean up**

Please leave the work surface of sinks as you would like to find it: wipe down and dry the deck surface with the techni-cloths that can be found in a dispenser that sits on top of the Aptchrome to the left of sink12 or at other sinks that you need to use for above cleaning processes. Dispose of used techni-cloths in the trash receptacle.

### **10.0 Troubleshooting Guidelines**

N/A

### **11.0 Figures & Schematics**

N/A

### **12.0 Appendix**

N/A