#1 PROCESS IDENTIFICATION

The process discussed in this Standard Operating Procedure (SOP) is Metal Lift-Off. Previously deposited photoresist overlaid with metal is stripped to reveal metal pattern.

This SOP assumes lithography of AZ-1512 Photoresist followed by deposition of aluminum and chromium onto a 3-inch silicon wafer. Refer to the SOPs for AZ-1512 Photolithography, Al Metal Evaporation, and Cr Metal Evaporation for details on those processes.

#2 MATERIALS

2.1 – Chemicals
The chemicals used in this process are acetone and isopropanol. Acetone is necessary to dissolve the photoresist overlaid with metal. Isopropanol is necessary to dissolve acetone remaining on the wafer.

2.1.1 Chemical Hazards
Acetone and isopropanol are extremely flammable. Refer to each chemical’s respective MSDS and/or SOP for the complete list of hazards.

2.2 – Personal Protective Equipment (PPE)
Wear chemical splash goggles for eye protection and neoprene gloves for skin protection. Wear an impervious lab coat, long pants, and closed-toe shoes for further protection.

2.3 – Additional Gowning
Shoe covers and hair nets should be worn to protect the clean room from contaminants.

2.4 – Additional Equipment

- De-ionized water
  - *This solvent is necessary to dissolve isopropanol remaining on the wafer.* *(De-ionized water is not safe for consumption.)*
- Wafer tweezers
  - *This equipment is used to safely transfer/maneuver the wafer.*
- 3 Petri dishes
  - *Two glass/plastic dishes for acetone and one for isopropanol. The Petri dishes should be sizable enough to fit a 3-inch wafer.*
- Timer
- Spinner
  - *The chuck should be sizeable enough to handle a 3-inch wafer.*
- Ultrasonic cleaner
- N₂ air gun
- 3 nozzle bottles
  - *One for acetone, one for isopropanol, and one for de-ionized water. Label the bottles accordingly. Refer to “#3 Special Handling Procedures” of this SOP prior to dispensing these chemicals.*
- Napkins

2.5 – Engineering/Ventilation Controls

Acetone and isopropanol should be used in an explosive-proof well-ventilated area, such as a fume hood. Eyewash and safety showers should be within reach of workstation location. Refer to each chemical’s respective MSDS and/or SOP for more details on engineering/ventilation controls.

Verify operation of fume hood, eyewash, and safety shower prior to use.

#3 CHEMICAL HANDLING PROCEDURES & STORAGE REQUIREMENTS

Acetone and isopropanol should be stored in labeled plastic bottles with tightly closed caps. Refer to each chemical’s respective MSDS and/or SOP for more a complete list of special handling procedures and storage requirements.

#4 METAL LIFT-OFF STANDARD OPERATING PROCEDURE

4.1 – Preparation and Verification of Equipment

1. Under the fume hood, prepare two Petri dishes with acetone. Place a third empty Petri dish in proximity.

2. Prepare the ultrasonic cleaner for use. Verify operation according to the equipment
3. Place one of the Petri dishes with acetone into the ultrasonic cleaner. Fill ultrasonic cleaner with de-ionized water until Petri dish is partially submerged.

![Ultrasonic Cleaner](http://kgtechservices.com/solutions.php)

**Figure 1. Ultrasonic Cleaner. (Photo from http://kgtechservices.com/solutions.php.)**

4. Prepare the spinner for use. Verify operation according to the manual.

**4.2 – Metal Lift-off (Stripping of Photoresist)**

1. Using wafer tweezers, place the wafer into the first Petri dish of acetone for 60 seconds. Ensure that the wafer is submerged and provide gentle agitation.

2. Immediately transfer the wafer to the Petri dish in the ultrasonic cleaner. Turn on the cleaner on low power for approximately 3 minutes. (High power levels may destroy the metal pattern.)
3. Next, immediately return the wafer to the original Petri dish of acetone. Keep the wafer in the dish for 60 seconds.

4.3 – Solvent (Acetone) Dissolution

1. Remove the wafer from the acetone and hold over the empty Petri dish with the tweezers. Gently spray the wafer surface and bottom with isopropanol while over the empty Petri dish. Do this for approximately 10 seconds.

2. Now gently spray the wafer surface and bottom with de-ionized water while over the Petri dish or fume hood sink. Do this for approximately 10 seconds.

3. (This next step prevents existing water droplets on the wafer surface from drying and creating water spots.) Next, place the wafer onto the spinner chuck. Turn the vacuum on. Gently nudge the wafer with the tweezers to verify that vacuum is on.

4. Gently place a meniscus of de-ionized water onto the wafer surface. Then start the spinner. Allow to spin for a 30-60 seconds at 4000 rpm.

5. Once the spinning is complete, turn off the vacuum and remove the wafer using the tweezers. Dry the back of the wafer using the “AIR” nozzle in the fume hood or an N2 air gun.
4.4 – Wafer Inspection (to Confirm Metal Lift-off)

1. Inspect the wafer surface under a microscope to confirm proper metal lift off. If metal lift-off was not successful, repeat the above procedures from “4.2 – Metal Lift-off” through “4.3 – Solvent (Acetone) Dissolution”.

2. If metal lift-off was successful, return the wafer in its tray and store away until the next process.

4.5 – Solvent Degreasing and Cleanup


2. For disposal of remaining acetone and isopropanol, refer to the corresponding MSDS or SOP.

#5 Spill and Accident Procedures

In case of eye contact, skin contact, inhalation, and/or ingestion:

Refer to the respective MSDS or SOP for that of acetone, isopropanol, and de-ionized water.

Refer to the equipment manual for the ultrasonic cleaner.

#6 Waste Management

Refer to the respective MSDS or SOP for that of acetone, isopropanol, and de-ionized water.

#7 Special Precautions for Animal Use (if Applicable)

Not applicable.

Particularly Hazardous Chemicals/Chemical Classes

Acetone is a suspected reproductive toxin. For more details, refer to “Appendix H: Particularly Hazardous Substances” of the Laboratory Safety Manual.
#8 Approval Required
Supervisor training on the “Acetone” SOP. Supervisor training on basic lab emergency procedures.

#9 Decontamination
Refer to the respective MSDS and/or SOP for decontamination details concerning acetone and isopropanol.

#10 Designated Area
Acetone and isopropanol should be handled in an explosion-proof ventilated area. Refer to the respective MSDS and/or SOP for more details on these two chemicals.