Sigma-Aldrich®
Lab & Production Materials

ALUMINUM ETCHANT TYPE F

Etchant for Al and Al-Si Metallizations

Chemical etchant compatible with negative and positive photoresists for etching aluminum or aluminum/1% silicon (AlSi) deposits.

ALUMINUM ETCHANT TYPE F

DESCRIPTION:

Aluminum Etchant Type F is a stable preparation used to etch aluminum or aluminum-silicon metallizations on silicon devices and in integrated circuit applications. Aluminum contacts are defined and interconnections are formed. Aluminum Etchant Type F is formulated with unique properties easily overcome many of the difficulties experienced in aluminum etch processes such as residue. The aluminum metallization and etching process using photo-lithographic techniques is basic to the semiconductor and microelectronic technology. Aluminum Etchant Type F is highly compatible with commercial photoresists (KTFR, AZ, Hunt, Waycoat, etc.) and permit delineation into high resolution patterns. Metal line width of 1 mil and separations less than 5 microns are feasible. The high resolution is practical with Aluminum Etchant Type F because lifting of photoresist patterns does not occur and undercutting is minimized.

APPLICATION:

Aluminum Etchant Type F should not be used or stored in glass or Pyrex containers.

Aluminum metallizations up to 25,000 Å are vacuum deposited on the silicon slice, coated with a photoresist, and UV exposed using an appropriate photographic mask. The resist is developed to protect the aluminum where interconnections are desired. Then the unprotected areas of the aluminum are removed by etching with Aluminum Etchant Type F, followed by a water rinse. Etching time is dependent upon the etchant temperature and the aluminum film thickness. When etching thick aluminum films, a higher etch rate is required; thus a higher etchant temperature should be used. Likewise, for thinner aluminum films, slower etch rates are desired and a lower etchant temperature should be chosen. At a specific etchant temperature, the etching time is given by the following formula:

$$\text{Etching time (second)} = \frac{\text{Film Thickness (Å)}}{\text{Etch Rate (Å/sec)}}$$

PROPERTIES OF ALUMINUM ETCHANT TYPE F

How do I increase the etch rate?	The rate will approximately double with every 10 °C increase in temperature. Increase the rate of stirring or agitation.
How do I reduce the etch rate?	Adding 1 part deionized water to 2 parts etchant will reduce the etch rate approximately 50%.
Do I need to dilute the etchant?	No, it is ready to use.
How do I reduce undercutting?	Increase the rate of stirring or agitation.
Appearance	Clear, colorless-to-light yellow liquid
pH	Strongly acidic
Etch Rate at 25°C 40°C 50°C 65°C 75°C	 30 Å /second 80 Å /second 100 Å /second 240 Å /second 550 Å /second
Etch Capacity (rate declines at ~70%)	80 g/gallon
Shelf Life	1 year
Storage Conditions	Ambient
Filtration	0.2 μm
Recommended Operating Temperatures	20-80 °C (30-40 °C most common)
Rinse	Deionized water; may be followed by alcohol rinse if desired.
Photoresist Recommendations	KLT6000 Series, KLT 5300 Series, HARE SQT (SU-8 type), TRANSIST, or PKP II
Select Compatible Materials	Au, SiO_2, Pt, W
Select Incompatible Materials	Ni, Cu, Al, Al_2O_3, C, Co, Cr, Fe, GaAs, Mg, MgO, Nb, Ni, Pd, Ru, Si, Si_3N_4, Steel, Ta/TaN, Ti, ZnO
Compatible Plastics	HDPE, PP, Teflon, PFA, PVC
Country of Origin	USA
Packaging	HDPE
Isotropy	Isotropic
Incompatible Chemicals	Strong bases
Additional Information	Etch rate may vary with aluminum purity.