

Area of use

Au-etch-200 is a non-hazardous, cyanide-free, slightly alkaline etchant for Au. The etchant is used for the wet-chemical patterning of Au layers with selectivity to metals like Pt, Ni, Cr, Ti, Al. Common areas of use for semiconductor fabrication or microsystem technology.

Advantages and Requirement Profile

Au-etch-200 is compatible with common resist, shows very low undercut (in the dimension of the layer thickness) under a resist mask pattern and offers selectivity to numerous materials.

Au-etch-200 is very useful for the patterning of Au layers using resist mask patterns or for the selective removal of seed layers after plating process steps, where plated feature must not be attacked by etchants. Au-etch-200 is available in different purity grades. The etchant is not hazardous and easy to handle.

Au-etch-200 fits to the following requirement profile:

- Low undercut (in the range of the layer thickness), minimum feature size < 1µm
- Selectivity to many materials, e.g. common metals used in electroplating industry
- Available in different purity grades
- Compatible to resist masking
- Not hazardous substance and easy to handle

Inteded Use

- Usable for manual process, tank or etching equipment
- Use in laboratory or production environment only
- Use for commercial application only

Selectivity

Au-etch-200 is compatible/etches selective to following materials:

- Resists: common Novolak as masking resist (e.g. AZ[®] Photoresist)
 - Metals: no attack on Cr, Pt, Ni, Ti, Ta, Al; Cu is attacked
 - Semiconductor materials: Si, SiO₂, Si₃N₄
- (further information an request)

Etching rate / capacity

Under normal condition, the etching rate is around 40nm/min (at 50°C).

The mixed etching solution is stable over time and can be used multiple times depending on the requirements of application. It is recommended to dispose the solution at the latest, when the etching rate has changed by 20%.

Order number / Article number/ Shipping form

Au-etch-200 is shipped ready for use.
As a standard, all compounds used are level „pro analysis“.

Order number: Article number + Container-Code

	Article number	Container-Code				
		1l	2,5l	5l	10l	20l
Au-etch-200 (ready-to-use)	103200-40	D	E	F	G	H

On request: - Certificate of Analysis with individual requirements regarding elements
- etching solution in other purity grade or special grade regarding specific elements

Mixture

The solution is shipped ready for use.

Etching conditions

Temperature: >50°C (do not exceed 60°C)
Tank: Tank for batch process, Petri dish for manual application
Agitation: medium;
Circulation; stirring bar; autom./ man. agitation of work piece
Etching rate: 40nm per minute (at 50°C)
Pretreatment: where applicable descum / oxygen plasma for improving the wetting properties of resist or metal mask (no wetting agents needed)

Etching result / inspection

The completed removal of the Au can be identified by visual observation. There should be no visible residue of Au, which should be verified by inspections with optical microscope.

General application notes

Pretreatment

Substrates should be pretreated in oxygen plasma, in order to remove any potential organic residues and to improve the wetting properties of the solution on resist masks. The surface is getting hydrophilic and no extra wetting agents are required.

Etching process

During the etching process, sufficient agitation of the solution or of the substrate is needed. If used in manual processing, the etching time required can be identified by observing a color changeover in the open etching areas and. After visual qualification the etching should be continued for 10% bis 15% of the time elapsed, in order to assure the removal of any residues.

Post treatment

Thorough cleaning with DI-water / quick dump
Rinsing dryer or manually drying with nitrogen nozzle

Additional application notes for the use in etching equipments with circulation

The etching solution is sensitive to air/CO₂ entrapments and pH drop. The sulfur inside the compounds tends to precipitate. The circulation system and filter may be affected, when precipitation happens during permanent circulation.

As a consequence:

1. Permanent circulation is not preferred. In idle times the solution should be stored in the tank without main circulation (just some agitation in the tank while heating), so main circulation should only be in operation, when etching is performed.
2. Make sure that the circulation system and filtration system is sealing well against air entrapment. Use nitrogen atmosphere in tank and tool system.
3. Spray tools will be preferred over batch tools.
4. pH control is mandatory, pH should not drop below 8.
5. The etching only works well starting at 50°C, at 45°C etching is not working well. For stability reason, the solution should not be heated over 60°C. Therefore, indirect heating with a heat exchanger is preferred. Where possible, apply heating of the solution on the fly, near the nozzle of the spray tool. Where possible, have the wafer chuck heated as well, so the wafer can be set to a specific temperature.

Precautionary measures:

Regular visual control routine should be performed, if any precipitation has taken place.

- Precipitation can be suspected /observed/identified,
 - o when the flow rate drops (then filter is jammed)
 - o precipitates are visible in the tubes
 - o precipitates are visible in the tank (swimming on the surface of the solution or agglomerated at the bottom of the tank)

When precipitation is observed, the solution should be drained immediately.

If precipitation in the tank has taken place:

- The tank should be cleaned manually, so tank systems are preferred, which are easily to be maintained.
- The precipitation can be dissolved using boiling sodium sulfite solution, so the system should be compatible with T ~ 95° C for such cases. Further instruction can be received at NB Technologies.

Tool requirement summary

- Spray tool usage is preferred.
- Apply Nitrogen atmosphere in tank/tool system.
- Circulation system must be sealing against air entrapment.
- Circulation needs to be restricted in idle times.
- Indirect heating in operation and heating control for 50°C to 55°C
- pH control is mandatory.
- Heating capability at the nozzle and of the wafer chuck is advantageous.
- Temperature compatibility and heating capability for 95°C is advantageous for cleaning.
- Easily accessible tank/tube installations are advantageous for cleaning.

Additional application notes for manual etching process

The etching only works well starting at 50°C, at 45°C etching is not working well. For stability reason, the solution should not be heated over 60°C.

Precautionary measures:

- Use indirect heating only, when using in a tank as well when using a Petri dish.
- Use closed loop temperature control for heating.
- **Never use direct heating on a hotplate!**
 - o If the solution evaporates in total while heated on the hotplate, hazardous reaction may occur.
 - o The solution may be overheated and the complexing agent may decompose.
- If using a Petri dish with a hotplate, use a water bath for indirect heating.
 - o Put the Petri dish containing the etching solution inside the water bath.

Known issues / trouble shooting

Inhomogeneous etching result / incompleting etching

- Poor wetting / no descum or plasma executed
- Etching solution / etching capacity is consumed
- Not enough agitation

Poor resolution / high undercut

- Poor adhesion of resist
- Excessive etching time

PRODUCT STABILITY NOTES

In order to prolong the usability period of the product after opening of the bottle, the bottle should be flooded with nitrogen when closed again. Air atmosphere may result in accelerated precipitation of sulfur compounds.

Safety and disposal notes

This mixture is not classified as dangerous according to Regulation (EC) No. 1272/2008. Refer to the safety and handling recommendations of the material safety datasheet before use.

Do not empty into drains or the aquatic environment. Collect used or unused solution in containers and perform waste disposal according to official state regulations. Cleaned containers may be recycled.

Technical Support

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