Nickel etch using

INRF application note
Process name: NickelEtch

Overview

This process etches Nickel by using an acidic solution or a pre-made ferric chloride (FeCI3) solution.

Time needed

The time of this process depends on the thickness of the film. The etching rate of the acidic solution depends on the dilution of DI water. Process can be finished by observing Ni vanishing.

INRF also provides pre-made Ni etchant solution which has the etching rate of the FeCI3 solution is 1.25 um/min at 40 deg C.

Materials needed

Nitric acid (HNO3)
Acetic acid (CH3COOH)
Sulfuric acid (H2SO4)
DI water
Glass container

Preparation

Setup time for this process is about 5 minutes. The general recipe is for the acidic etching solution is shown below:

5 parts of HNO3
5 parts of CH3COOH
2 parts of H2SO4
DI water as desired

Another option is to directly use the solution provided by INRF stored in the red cabinet of the Sample Preparation room.

Procedure

Always pour acid into water. Prepare 100 ml of DI water (quantity of water depending on the etch rate that you prefer) in the glass container. Pour 50 ml of HNO3, 50 ml of CH3COOH, and 20 ml of H2SO4, into the container with mixing. Soak the substrate into the solution with mild agitation. Check substrate by DI rinse every 30 seconds or every minute until the Nickel color is gone. After a thorough DI rinse blow dry the substrate.

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You can also use the prepared FeCI3 solution provided by INRF. Pour approximately 1100 ml Nickel etchant solution into a glass container. Heat the solution on a hotplate to reach approximately 40 – 60 deg C. The etching rate of the FeCI3 solution is 1.25 um/min at 40 deg C. Near the expected etch time check the substrate by DI rinse every 30 seconds until the Nickel color is gone. After a thorough DI rinse blow dry the substrate. The etchant may be re-used if clean. Put recycled etchant back in proper location (in assigned location under fume hood).

Clean up

If the etchant becomes old or dirty it should be discarded. Dispose the waste Nickel etchant into appropriately labeled plastic waste bottle. Rinse all containers three times in clean water.

Safety and emergency

All INRF safety and procedural regulations must be followed. Review the INRF Standard Operating Procedures for fire, chemical spill, and chemical exposure.

Avoid skin contact of Ferric Chloride. Sulfuric acid and nitric acid can cause severe burns, and may be fatal if inhaled or swallowed. Keep in tightly closed container. Perform the process in the fume hood.

In case of exposure to skin or eyes flush immediately with water for 15 minutes. Remove all clothing that are exposed and flush with water. Report to INRF staff or report to EH&S. Seek medical attention to ensured that the burns are minimal.

In case of a large spill follow the INRF Standard Operating Procedure for chemical spills.

References

Transene Company, Inc.

Prudent Practices in the Laboratory, National Research Council, 1995.

W. Kern and J. Vossen, Eds., *Thin Film Processes*, Academic Press; New Yorkm 1978, Ch V-1.

Nickel Etching Checklist

The following checklist is designed to aid the researcher when performing this process.

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Prepare Ni etching solution:

5 parts of HNO3
5 parts of CH3COOH
2 parts of H2SO4
DI water as desired

Or use the prepared FeCI3 solution provided by INRF. Heat the solution on a hot plate and keep the temperature between 40 deg C – 60 deg C

Soak the substrates in the etchant until the Nickel color is gone. The time of the process depends on the etching rate and the film thickness.

DI rinse and blow dry

Clean up, and recycle waste into a labeled plastic bottle.