**Etching of Stainless Steel using Hydrochloric Acid**

Standard Operating Procedure

Lab: 206J - Lambros

Department: Aerospace Engineering

PI/Manager of Space: Prof. John Lambros

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**Section 1: Overview**

Type of SOP: [ ] Process [x] Hazardous Material [ ] Hazardous Class of Materials [ ] Equipment

Synopsis:

*This SOP describes the proper equipment use, handling, and procedures for etching Stainless Steels using Hydrochloric Acid. This method should be reviewed prior to handling any powders to avoid risks of exposure via inhalation or skin. This SOP covers all the equipment necessary, present in 206J.*

**Section 2: Risk Assessment Summary (Hazards and control measures)**

*Information obtained from performing a risk assessment should be entered into this section.*

Materials:

|  |  |
| --- | --- |
| **Material (name, CAS #, other ID)** | **Hazards** |
| Hydrochloric Acid 10N Solution | May be corrosive to metals. Causes severe skin burns and eye damage. May cause respiratory irritation. |

Relevant References for Material Hazards:

|  |
| --- |
| Find MSDS for all materials above either in MSDS Binder in 206J or at the following web pages (direct link to MSDS)**Hydrochloric Acid 10N:** <https://goo.gl/3YxnGv>  |

Equipment Hazards:

Equipment is considered low hazard. Do not touch the hot surface of the Hot-Plate. Take caution when handling Hydrochloric Acid, especially after heating (Always use Nitrile disposable gloves and only handle the Acid inside the Fume-Hood). Avoid heating the acid above 90 degrees.

Hazardous Conditions:

Always verify the airflow of the Fume-Hood prior to opening Acid containers (change pre-filter in case of clogging, See Fume-Hood SOP). Never stick your head inside the Fume-Hood. In case you smell something different, stop the procedure immediately, sealing the Hydrochloric Acid in proper containers.

Technique Hazards:

* Transferring Acid from one container to the other (may cause spilling).
* Heating the Acid above 90 degrees (causes the filters to not work properly)

Personal Protective Equipment

The following are in addition to proper dress for work in a laboratory:

- Safety glasses

- Nitrile disposable gloves

Engineering Controls

- Store used Acid in a proper plastic/glass container, inside anti-spill tray. Usually located in cabinet under the Fume-Hood.

- Keep the unused Acid bottle in the same tray and cabinet as the used Acid container.

**Section 3: Procedures (Etching)**

1. Wear PPE equipment (glasses and gloves) prior to starting
2. Turn the Ductless Fume-Hood on and check airflow.
3. Get two small glass containers and place one of them empty on top of the Hot-Plate, and the other filled with water by the side of the Hot-Plate.
4. Gather the Hydrochloric Acid bottle and place inside the ductless fume hood (only open the bottle after placing it inside the Fume-Hood). Fill the container on top of the Hot-Plate with Acid.
5. Close the container and store it.
6. Fully submerge the polished specimen in the Acid container (using a stainless steel tweezers).
7. Turn Hot-Plate on and set it to 80-90 degrees.
8. After 15-30 minutes the Acid should have strong yellow color. The specimen surface should be visibly less reflective.
9. Remove the specimen from the Acid container (using a stainless steel tweezers) and submerge it into the water container.
10. Turn the Hot-Plate off and wait until the Acid has cooled down (do not handle hot Acid).
11. Place used Acid inside proper glass/plastic container (see next section for disposal).
12. Remove the specimen from the water and dry it using air blower (throw water away in the sink).
13. Clean up area per Section 4 below.
14. Remove PPE equipment. Dispose gloves in contaminated trash, put away glasses.
15. Wash your hands in sink!

**Section 4: Waste Disposal/Cleanup**

In case of any spilling, the Acid must be cleaned before turning off the Fume-Hood. Follow below procedure:

1. Wipe surfaces with towels or kim-wipes.
2. Dispose of the towels or kim-wipes in special contaminated trash container which includes towels and gloves. Do not throw away contaminated gloves or towels in regular trash can.
3. In case of major spilling, use the Acid neutralize found in the Spill Kit.
4. Any used Hydrochloric Acid should be stored in proper glass/plastic containers. Do not store more than one used Acid container. Contact DRS for pick-up of used Chemicals.
5. Contact DRS for pick-up of contaminated trash.

**Section 5: Emergency Response**

Acid neutralizer can be found inside the Spill Kit

Review the location of nearest safety shower/Eye wash before starting the procedure.

**Section 6: Additional Information**

Checklist:

[ ] Read (Material) Safety Data Sheets.

[ ] Completed Lab Safety Training (General, Chemical Handling)

[ ] Another researcher is nearby and knows the hazards present.

[ ] Additional gloves and masks are available in case those being used become contaminated.

References:

*Additional information in General etching procedures can be found in ASTM E340-15 standard. Also, refer to the DRS wesbsite for any questions you may have on disposal and training.*

**Training Documentation**

Signing this document means that you have read and understand all aspects of this Standard Operating Procedure.

The supervisor is the person that acknowledges you took the training and understand the procedure. They can be a lab manager or researcher assigned by the PI to oversee this particular SOP.

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| **Name (Printed)** | **Name (Signed)** | **Supervisor** | **Date** |
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