CORAL Name: Acid-Etch-General / Acid-Extended

Location: L06, U07, U10
Category: Corrosive Wet Chemical Processing
Contact: Maansi Patel, Scott Poesse

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1 Introduction

The Acid-Etch-General and Acid-Extended acid hoods are general-purpose wet process hood for corrosive chemical cleaning and etching. They contain a sink for rinsing and pre-cleaning procedures and large flat deck sections for flexible beaker or tank-scale processing. The aspirator and drain of this hood are connected to the central acid waste neutralization system (AWN) for corrosive waste disposal of approved chemicals. The hood is made of polypropylene and the decking is made of acid-resistant PVDF. This hood is for processing of corrosives chemicals only, organic solvents are not allowed. Generally speaking, these hoods serve the same function and are interchangeable, however some unique features for each hood are listed below.

1.1 Acid-Etch-General-U10:

General, all purpose corrosive processing, cleaning processes, and wet etching including metal etchants such as gold and aluminum that are compatible with drain disposal can be performed in this hood. Pieces and single wafers that require metal etches should be processed in this hood. This hood also has benchtop hotplates available for corrosive processing that requires heating.

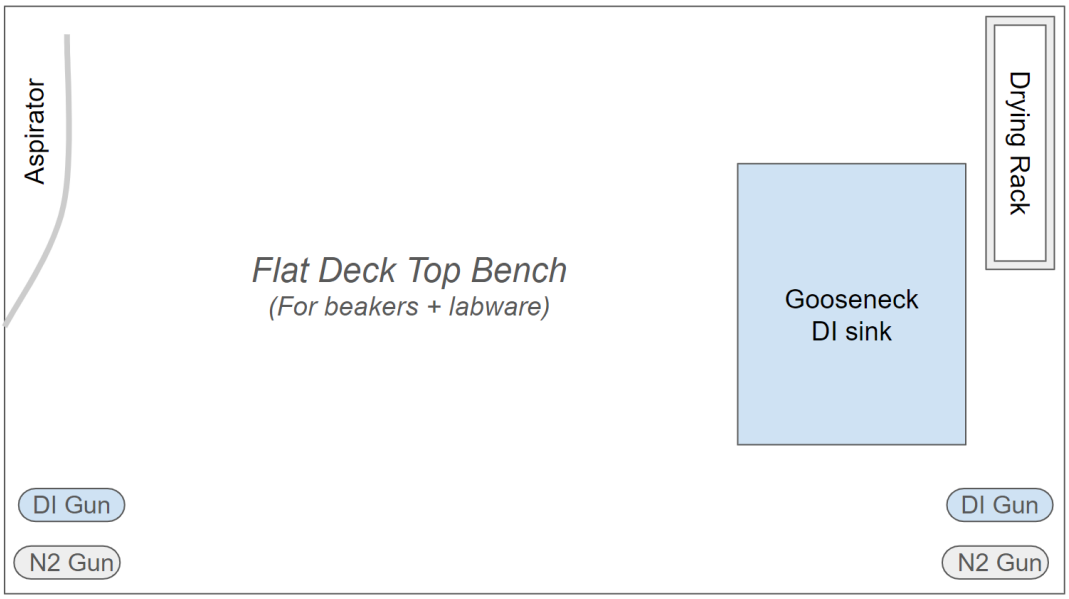
1.2 Acid-Etch-General-L06:

General, all purpose corrosive processing, cleaning processes and wet etching can be performed in this hood. Specialty etchants (such as gold or aluminum etchants) are currently NOT stocked on the lower level and processes that require those must be performed in Acid-Etch-General-U10. This hood also has access to a benchtop heated water bath and Yellow-labeled labware for K+ and Na+ chemistry.

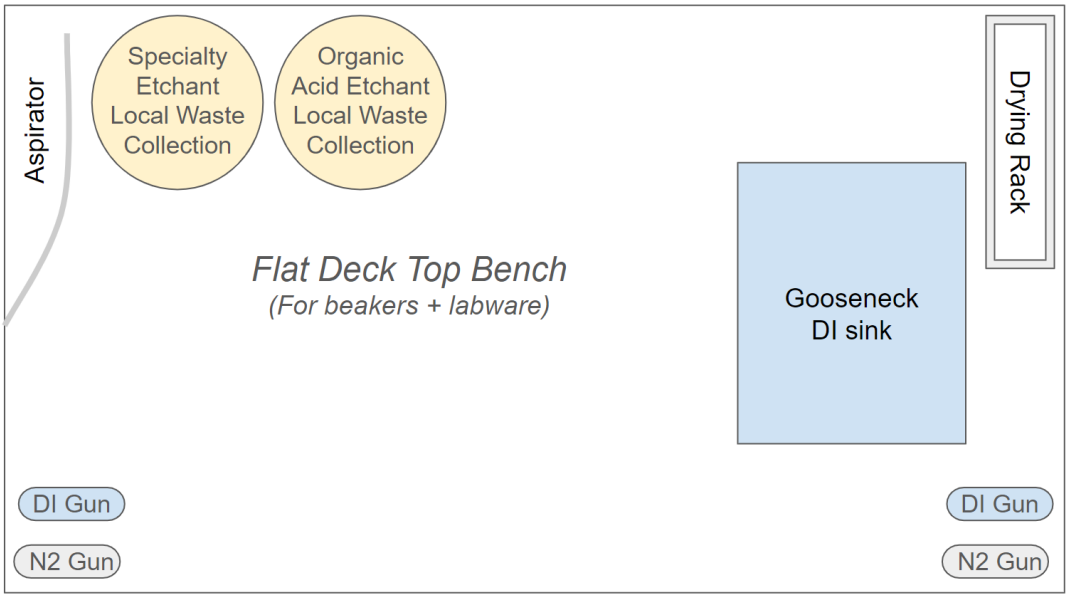
1.3 Acid-Extended-U07:

Extended corrosive processes that last longer than 3 hours should be performed in this hood. This allows the primary Acid-Etch-General hoods above to remain available to users for shorter processing steps. Processing that requires local corrosive waste collection for drain prohibited material etching must be performed in this hood. This includes: Chromium, Nickel, Copper and Arsenic (GaAs) etching. The hood and nearby storage cabinet have local storage for the specialty etchants associated with those processes. Any other processes that remove drain-prohibited materials from samples with corrosive chemical will also be processed here so the waste can be collected locally.

Acid-Etch-General-U10/L06 *(overhead view)*



Acid-Etch-Extended-U07 *(overhead view)*



2 Safety

Personal Protective Equipment: Acid protective gear MUST be worn when working at this sink and when transporting or handling chemicals. An acid-proof apron with sleeve guards, dual-layer acid gloves (atop the standard gowning vinyl cleanroom gloves), and a face shield worn over safety glasses, are all required. ALWAYS know the location of the nearest eye wash and safety shower.

Exhaust: Before using the acid-hood, verify that the control panel is powered on and is not in alarm for low exhaust or other errors.



Figure 1: Location of emergency override button on the wet bench.

- In an emergency push the override button on the exhaust monitor to fully open the Smart Phoenix Valve and maximize exhaust.
- Do not attempt to adjust the exhaust louvres, they have been set and calibrated to achieve the correct flowrate.
- **Never, for any reason, put your head inside the hood.**

Chemical Transport and Handling:

- SDS sheets for all chemicals can be found online and are linked in the appendix. Users should review and be familiar with the appropriate SDS before using these chemicals.
- Transport chemicals to and from the acid hood using the red chemical cart or a secondary containment bucket.
- Always handle chemical bottles with dry, gloved hands (nitrile-neoprene acid gloves).
- Typically, acids should be added last to solutions.
- A variety of acids and bases including specialty etchants are available in the local corrosive passthrough or in the drawers located in the base of the acid hood.
- Chemicals are segregated by compatibility. Be sure to return chemicals to their appropriate passthrough compartment.

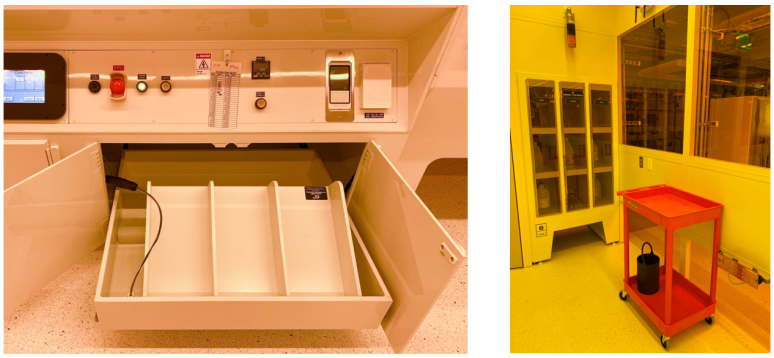


Figure 2: Chemical storage underneath hood and local corrosive passthrough

Chemical Exposure: In case of chemical exposure, immediately go to the nearest shower or eyewash. Immediately remove all contaminated clothing and flush or rinse the exposed area with water for 15 minutes; for exposures to HF, see below. Call for help to other users nearby so they can provide assistance. During the treatment have other users call the MIT.nano ERT phone number 617-258-8674. Immediately after treatment seek professional medical attention by a physician. In emergency situations call 100 for MIT police from any campus landline, or 617-253-1212 from a cell phone and request an ambulance for transportation.

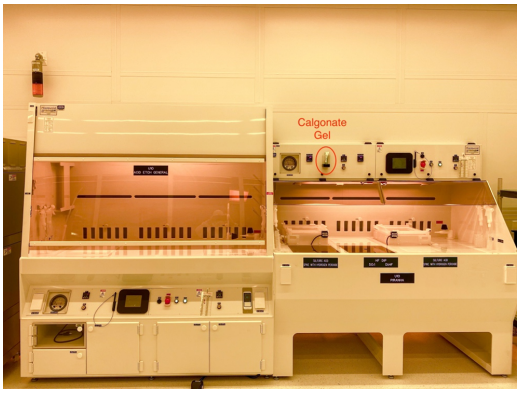


Figure 3: Location of Calgonate gel on hood.

HF Specific Safety: The chemicals used in the acid-hood are all dangerous to touch or inhale. Hydrofluoric Acid (HF) is especially hazardous. An insidious aspect of HF burns is that there may not be any discomfort until long after exposure. These burns are extremely serious and may result in bone tissue damage. If you suspect exposure to HF, flush the area well for 5 minutes and be sure to work under and around your fingernails, then apply calcium gluconate gel liberally to exposed area. Immediately after treatment report to a professional medical center for examination by a physician. Remember, HF may not produce any burning sensation until after it has already done damage. HF is also present in buffered oxide etch (BOE) solutions.

3 User Qualifications and Responsibilities

Qualifications:

- Read and understand the SOP for Corrosive Processing Rules,
- Review all videos and documents on the MIT.nano Wet Chemical Training Course
- Attend the in-person portion of the MIT.nano Wet Chemical Training Course,
- Complete a one-on-one hands on training session with an MIT.nano staff member,
- Must have an approved PTC process. If you would like to alter the chemistry of your process, re-submit the PTC Process and wait for approval.

Responsibilities:

- Put away all drying labware on the rack back on the shelf.
- Report when the last of a chemical has been used up or when there is a very small amount left. Call the Lab Support Phone so staff can proactively restock the chemical for the next user.
- Rinse the deck after your have completed your work and use the squeegee to completely dry the bench top.
- Reserve the time you need and engage the hood in CORAL. This is critical for awareness to MIT.nano Staff and other users.
- Only one user at a time is permitted to actively be working in a hood.

4 Procedure

1. Check reservations in CORAL to ensure you have reserved the correct tool at the correct time. Engage the tool in CORAL.

2. Prepare your samples by placing them in the correct cassette, basket or carrier obtained from the labware shelf. A Sample Prep-Station is available for transferring samples.



Figure 4: This table is used as the "Prep-Station"

3. Contamination control is of critical importance in all MIT.nano equipment. You should know which category your samples fit into (acid-metal or acid-no-metal) and use the appropriate labware for processing the samples. Cross contamination can be harmful to equipment as well as to experimental results. If you have any questions about which one to use, please ask the MIT.nano Staff.

4. Gown up by donning the appropriate PPE in this order:

   (a) Dual-layer, nitrile-neoprene acid gloves.

   (b) Acid Apron with Arm Sleeves

   (c) Face Shield

   Any PPE that is in poor condition or contaminated during use should be discarded and replaced. In particular, check the integrity of your gloves frequently and rinse often when handling chemicals. You can ask the staff for assistance or if you are not sure.

5. Obtain the appropriate labware, beakers, and hotplates and place them in the hood. Do not touch the inside of beakers or cassettes with your hands since this can introduce contamination. Use glass or quartz beakers for processing with most corrosive chemicals or when heating chemicals on the hotplate. Use Teflon or plastic beakers for processing any solutions that contain HF or BOE; heating of these chemicals may not be performed with a hotplate, see staff for other options.



Figure 5: This is the PPE + Supplies cart.

6. Retrieve the necessary chemicals from the passthrough and use the red chemical cart or the black bottle carrier to transport them to the bench. Place the chemical bottle inside the hood, remove the cap, pour the required amount of chemical into the processing beakers remembering to always add acid to water. Replace the cap, move the bottle back to the cart and immediately return the bottles to storage.
   (a) When using a hotplate, pour chemical solutions on the hood deck and carefully transfer the beaker to the hotplate surface.
7. Process your samples as required. Each sample must be subsequently rinsed in clean water 4 times to decontaminate the sample.
   (a) Fill a beaker with water and immerse the sample, agitating as needed.
   (b) Fill a second beaker with water and transfer the sample.
   (c) Empty and refill the first beaker and transfer the sample.
   (d) Empty and refill the second beaker and transfer the sample.
   (e) Transfer the sample to the Prep Station for drying.
8. When processing is complete and your samples are rinsed and dried, proceed to aspirate and clean all beakers.
   (a) On the Hood Control Touchscreen, find the aspirator control and push the button to turn it ON and OFF.
   (b) Insert the aspirator hose into your beaker and aspirate until the chemical is removed.
   (c) Refill with water and aspirate a second time.
   (d) Fill and empty beakers 3 times before putting away to dry on drying rack. Rinsing 3x helps to dilute even highly concentrated acids to near-neutral levels.

(e) *Rinsing beakers on the hotplate:* It is not safe practice to move the beaker off the hotplate with chemicals inside. Instead, aspirate the chemical and refill with water on the hotplate surface, then transfer the beaker to the hood deck for the remaining rinse cycles. Use caution not to splash or spill on the hotplate.

9. Spray the hood deck down with water to rinse away any spilled chemicals. To minimize splashing: start on one side and work towards any puddles of possible chemicals (rather than spraying directly into a puddle). Use the squeegee to dry the deck.

10. Rinse gloves with water from the sink or spray gun and dry with a fab wipe. Remove safety gear in the following order to avoid contamination to shared PPE:

    (a) Dual-layer, nitrile-neoprene gloves

    (b) Face Shield

    (c) Acid Apron with Arm Sleeves

11. When processing is complete and the hood is clean and ready for the next user, disengage from the tool in CORAL. Enter accurate processing information into the CORAL dialogue as this is used for billing and tool maintenance.

5 Appendix

5.1 Local Corrosive Waste Collection

1. Open the yellow flip-top funnel of the compatible liquid waste bottle. If you are unsure, use the signs above each bottle to confirm.

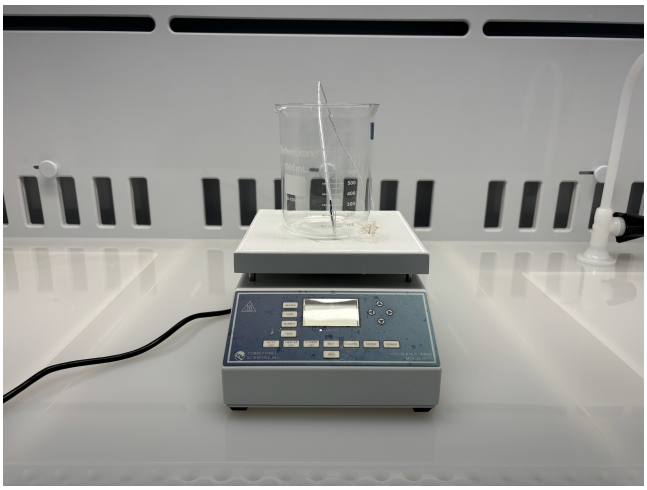


2. Carefully pour the corrosive material into the waste bottle. Place the emptied beaker on the deck. Close the yellow flip-top funnel, make sure it is securely clipped.

3. Use the DI water gun to fill the beaker to the max fill line. Then use the aspirator to remove the rinse water. Repeat 3 times.

4. For the DI water rinse beakers, you may use the sink to dump and refilled the beaker with DI water 3x

5.2 Hotplate Operation



There are two hotplates with control thermocouples available at Acid-Etch-General-U10 for heated processing.

Compatibility: Do NOT use the hotplate with any plastic or Teflon beakers, only glass beakers are permitted. HF attacks glass, and is not permitted on the hotplates. See staff for options if heating solutions with HF is required.

To use the hotplate:

1. Get the hot plate and thermocouple from the supply cart.
2. Plug the hotplate into the plug receptacle on the front panel of the bench. Plug the thermocouple into the back of the hotplate.
3. Fill beaker with chemical solution on the deck top. Then place the beaker onto the hotplate and insert the thermocouple probe.
4. Press the HEATER button on the hotplate control panel, then press the UP, DOWN, LEFT, and RIGHT buttons to set the value into the display. Press ENTER to enable heating.
   (a) When the thermocouple probe is plugged in, the hotplate will automatically control to the probe temperature in solution. To control the surface temperature directly, the probe must be unplugged.
5. When your process is complete, press HEATER OFF. If the corrosive solution is 80 degrees Celsius or below, aspirate the acidic solution directly on the hotplate. If it is higher than 80 degrees Celsius then you must wait for it to cool before aspirating. Fill the beaker with DI water directly on the hotplate, this will act as rinse 1. Aspirate the first rinse on the hot plate. Remove the beaker from the hotplate and complete the rest of the rinsing at the sink.

6. Unplug the hotplate and return to the cart ONLY WHEN THE HOTPLATE HAS RETURNED TO AMBIENT TEMPERATURE. If the surface is still hot, leave the unit plugged in so other users will be aware.

5.3 Timer Operation

The integrated timer units are seconds. To set the time press buttons 1 to 4:

1. To adjust single seconds
2. To adjust tens of seconds
3. To adjust hundreds of seconds
4. To adjust thousands of seconds



Figure 6: Timer control on bench

To start or stop the timer, press the large green “TIMER ENABLE” button. To reset the timer press RST. Sometimes the green button gets stuck, let staff know if that happens.

5.4 Additional Resources

The following additional resource are available. For any questions or topics not covered, reach out to MIT.nano staff for assistance.

Safety Data Sheet Library
Wet Chemical Training Resources
Stocked Chemical List
Drain Prohibited Materials