

Acid Fume Hood – Proper Use of Acids



1. Introduction

Acids are frequently utilized in lithographic and semiconductor processes. They are used to etch undesired materials, as well as for material processing and wafer preparation. Used correctly, acids are helpful and necessary tools for device fabrication. However, when used improperly, acids can be very dangerous. In fact, 50,000 injuries and deaths of laboratory workers have been attributed to unintentional exposure to hazardous chemicals in the U.S. Understanding and practicing proper safety protocols can greatly mitigate the risks to users' safety and well-being.



Figure 1: Chemical burn resulting from spill of a small amount of nitric acid

2. Features and Specifications

The acid hoods consist of a flat work area, some of which is covered by a translucent sash. All work areas are fabricated from materials that are resistant to damage from acids and other caustic chemicals. Within the area under the sash is laminar airflow that moves chemical vapors away from the user and out of the cleanroom.

Each acid hood features a DI water sink that can be used for dilution, as well as to rinse gloves and glassware after processing. In addition, each hood has labeled cupsinks at the anterior end of the hood where waste may safely be disposed of.

3. Safety and Precautions

- Untrained users **should not** handle acids or their containers.
- Always use proper PPE when working with acids. In addition to standard cleanroom attire, this includes an apron, face shield, arms sleeves and extended gloves, all of which must be resistant to corrosive chemicals.
- **Never work with acids while alone in the cleanroom.** Make sure that at least one of the present users is aware of the nature of your work and is close enough to assist you in the case of an emergency.
- Be aware of the nearest shower and eye wash station, as well as its proper use, before beginning.
- Always keep chemicals at least a foot away from the edge of the hood. This will reduce the likelihood of accidents and will prevent fumes from escaping into the cleanroom. Laminar air flow is only effective below the sash and within this 1-foot perimeter.
- Use proper pouring technique, as described later in this document, and place wipes under glassware to capture small spills.
- Clean any spilled chemicals immediately.
- Ensure that the lab ware and utensils you are using are compatible with your chemicals. Glass should not be used with HF and many types of tweezers are not suitable for acids. Contact NUFAB staff if you are unsure of compatibility.
- All chemicals that are left unattended must be clearly marked with chemical name, owner's name, contact information, time that the chemical will be removed and instructions for other users who will be working in the vicinity of the unattended chemical. **Never leave an unlabeled chemical unattended.**
- All chemicals for use in NUFAB are approved by NUFAB management. Please send email requests with chemical name, SDS, and quantity.
- Only open the cap of any chemical bottle inside the hood and under the sash.
- No waste goes down the drain. All waste must be handled according to the waste procedures.
- Do not mix chemicals without first verifying compatibility – never mix acids and solvents.
- When mixing etches, always add acid (AAA). Never add water (NAW) to acid.
- Do not use more chemical than is required for your experiment.
- Do not remove acids from samples or containers using the hood's spray guns – this will cause splashing of the acid.

- Refer to the SDS of every chemical that is to be used before handling that chemical.
- Follow all chemical safety rules.

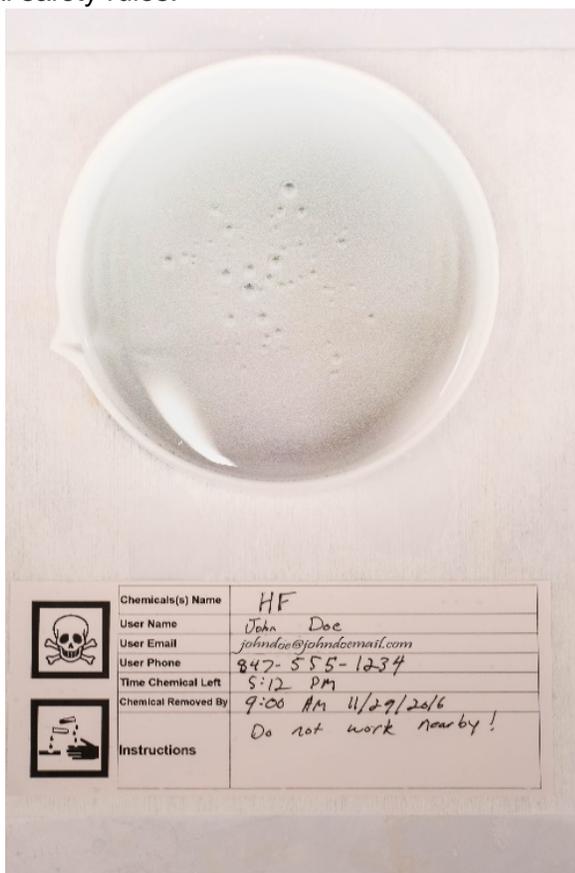


Figure 2: Properly labeled chemical container should include the chemical name, user name, contact information, time it was placed, time it will be removed, and any instructions necessary for other users who may be working in the vicinity.

PPE (Personal Protective Equipment):

All Personal Protective Equipment (PPE) must be worn at all times when working with acids. This equipment includes:

- ANSI approved safety glasses.
- Chemical resistant apron, secured at the waist and neck.
- Chemical resistant sleeves.
- Latex or nitrile gloves.
- Leak-free chemical resistant gloves, worn atop the latex/nitrile gloves.
- Full face shield to protect from splashing.
- **When working with HF/Buffered Oxide Etch, you must also have a container of calcium gluconate nearby and be familiar with its use.**

Remember: **PPE is that last line of defense**, not the first. It is there **only** for when all other protective measures fail.

4. Operating Procedure

1. Prior to using acids in the NUFAB facility, **users are required to provide a detailed Standard Operating Procedure (SOP) to the NUFAB staff.** Users will not be permitted to carry out the procedure until the SOP is approved.

The SOP should include a full description of the experiment that is to be performed. The following details should be included:

- Every step of the process.
 - What containers will be used in each process step.
 - What chemicals will be used and in what amounts.
 - What ancillary tools will be required, such as wafer tweezers, and what criteria these tools must meet.
 - What safety precautions, including the use of PPE, will be necessary for each step.
 - What methods will be used to dispose of waste and clean-up after the experiment.
 - All other pertinent details relevant to your specific process.
2. Before beginning, take a moment to remind yourself of the nearest eye wash/shower station and ensure that you have all of the proper PPE. Before use, check that each piece of PPE is in good condition with no tears, holes, etc. Check gloves for leaks by blowing air into them, twisting them to contain the air and then squeezing the gloves. Discard any damaged PPE and contact NUFAB staff for replacements before continuing.



Figure 3: Eye wash station in NUFAB A) with eye wash station closed, B) with eye wash station open

3. Prepare your work area by placing single layer of clean room wipes (the kind meant for general use, not ones designated for wafers) over a sufficiently large area of the fume hood's table surface. Make sure that this region is at least one foot from the edge of the fume hood. These wipes will help to capture any spills.
4. Place all necessary working utensils and chemicals on the cleanroom wipes you had prepared in the previous step (see fig. 4).

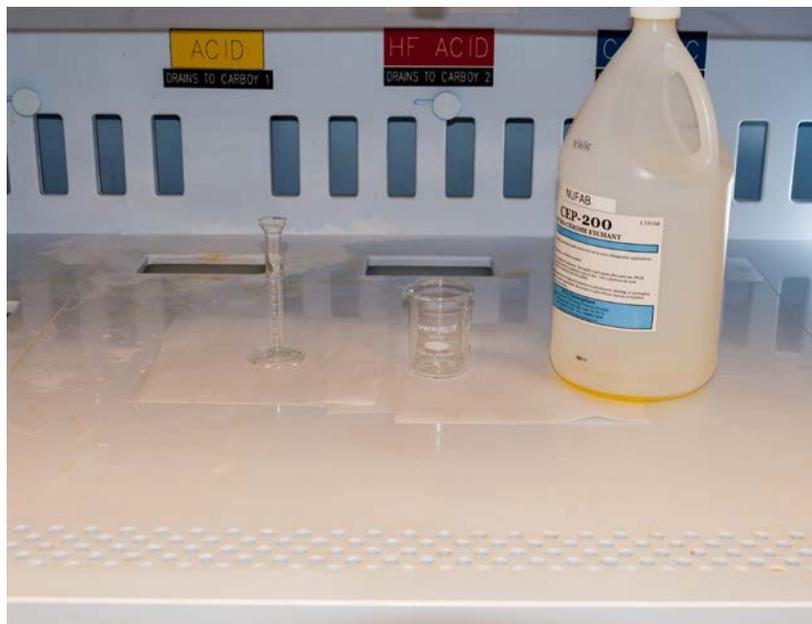


Figure 4: Use cleanwipes under working utensils to capture spills

Ensure that the utensils you are using are appropriate for the chemicals you are working with. For example, stainless steel tweezers are susceptible to corrosion when used with strong acids. Similarly, while glass containers are suitable for most acid applications, they are prone to attack by HF, which requires plastic containers. Consult NUFAB staff if you are unsure that your utensils are suitable for your experiment.

Check the chemical bottles to ensure that they are the right chemical, the right concentration, and that the bottle is clean of foreign chemicals or residue.

5. Pour out the amount of chemical that you will need for your experiment into the appropriate container. If you are pouring into a very narrow container, such as a graduated cylinder, use an intermediary container to reduce the likelihood of spilling (fig. 5). Clean any spills immediately (fig. 6). Pour out only enough chemical for your experiment. Using more chemicals than necessary is wasteful and unsafe.



Figure 5: Use a container of intermediary size when pouring from bottle to a small container



Figure 6: Clean up and spills immediately

6. When your experiment is complete, pour all unused chemicals into the correct cupsink at the back of the fume hood, being careful not to spill any chemicals onto the hood surface. When using large or awkwardly shaped glassware, you may find it necessary to first pour used chemicals into an intermediary container. Funnels can be used to reduce the likelihood of spilling.



Figure 7: Carefully pour unused chemical into appropriately labeled cupsink.

7. Rinse completely all labware at least three times with DI water using the provided sink. Do not use spray guns for rinsing chemicals – this will cause dangerous splashing of the chemicals.



Figure 8: Rinse all glassware thoroughly with DI water

8. Discard all cleanwipes in designated container and clean the working area with fresh cleanwipes.



Figure 9: Clean fume hood surface when finished.

9. Rinse off your gloves in a DI sink and dry with a cleanwipe before removing them.



Figure 10: Rinse gloves in DI water and dry with a cleanwipe before removal.

10. Return all PPE to its appropriate location.