

University of Minnesota, MN Nano Center

Standard Operating Procedure

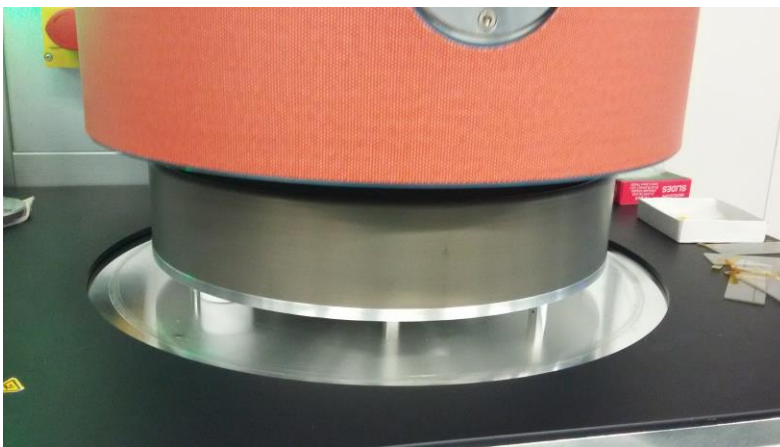
Equipment name: AV Etcher
Badger name: av-etch **Revision number:** 2
Model: Vision 320 **Revisionist:** Paul Kimani
Location: PAN – Bay 2 **Date:** Aug 12, 2015

1. Description

The AV Etcher is an RIE system with six (6) etchant gases available. These are: Argon (Ar), Trifluoromethane (CHF_3), Tetrafluoromethane (CF_4), Oxygen (O_2), Sulphur Hexafluoride (SF_6) and Methanol (CH_3OH). The system is designed to etch silicon, silicon nitride, silicon oxide, photoresists, other allowed organics and semiconductor materials. Using methanol vapors, magnetic materials (Co, Fe, Ni, etc.) can also be etched.

2. Safety

- a. While chamber is closing, ensure there are no items including limb in the path where the lid rests after closing.
- b. When lid has been open for more than 10 minutes, an alarm will sound and the lid will automatically close. Keep this in mind and keep hands clear off the descending lid.



3. Restrictions/Requirements

- a. Must be a qualified user on the AV Etcher

4. Required facilities

- a. Compressed air
- b. Chilled water
- c. Vacuum
- d. Ar
- e. CHF_3
- f. CF_4
- g. O_2
- h. SF_6

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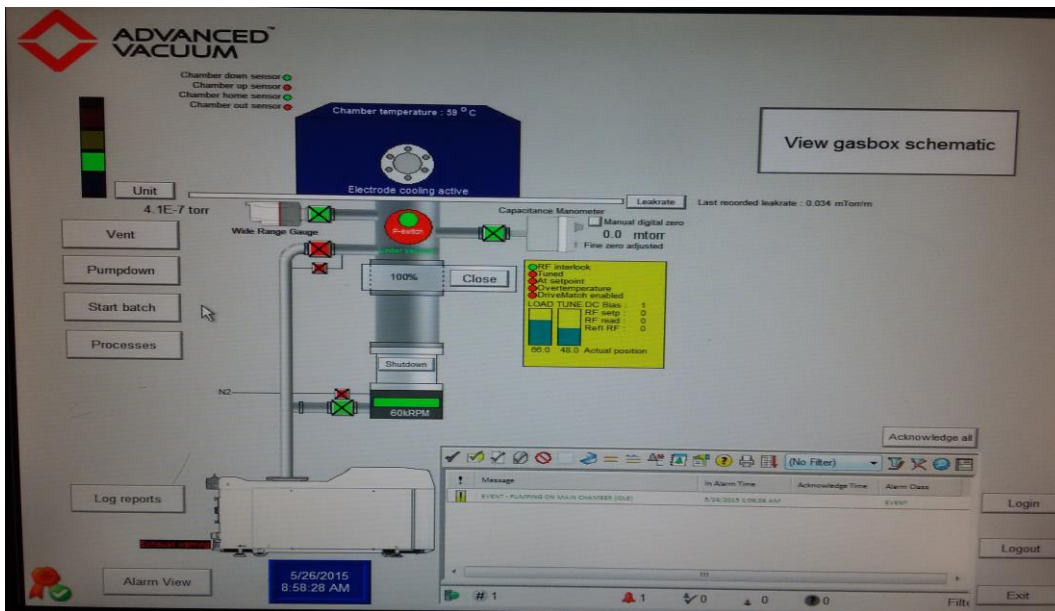
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- i. CH₃OH
- j. N₂

5. Notes

- a. All standard recipes found on the STS Etcher have been created on the AV system as well. Etch rates between the two systems do differ when using these standard recipes. Note that the AV Etcher utilizes a graphite chuck, while the STS Etcher has an anodized aluminum chuck.

6. Operating instructions



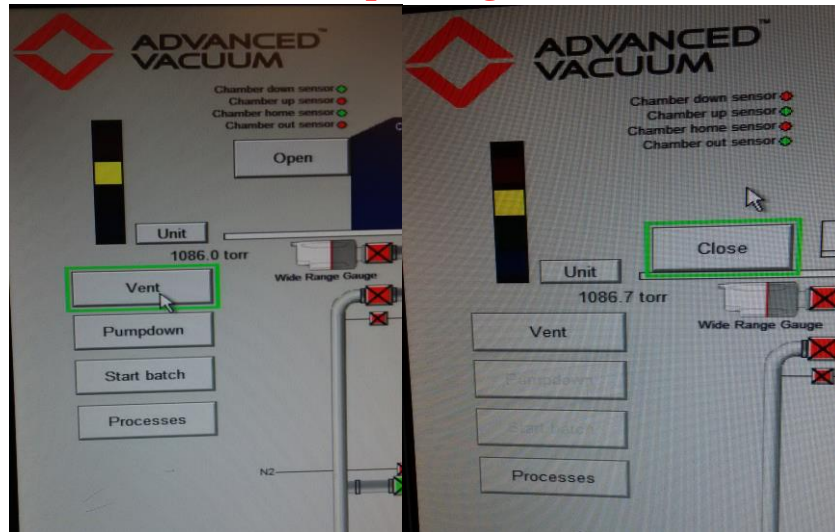
a. Logging on

1. Enable the “av-etch” using the MNC Badger system
2. On the main screen, click on the “LOGIN” button. If the login window is already open, then you can enter the username and password.
The username is: **operator** and the password is: **operator**
3. Click on the “USE” button

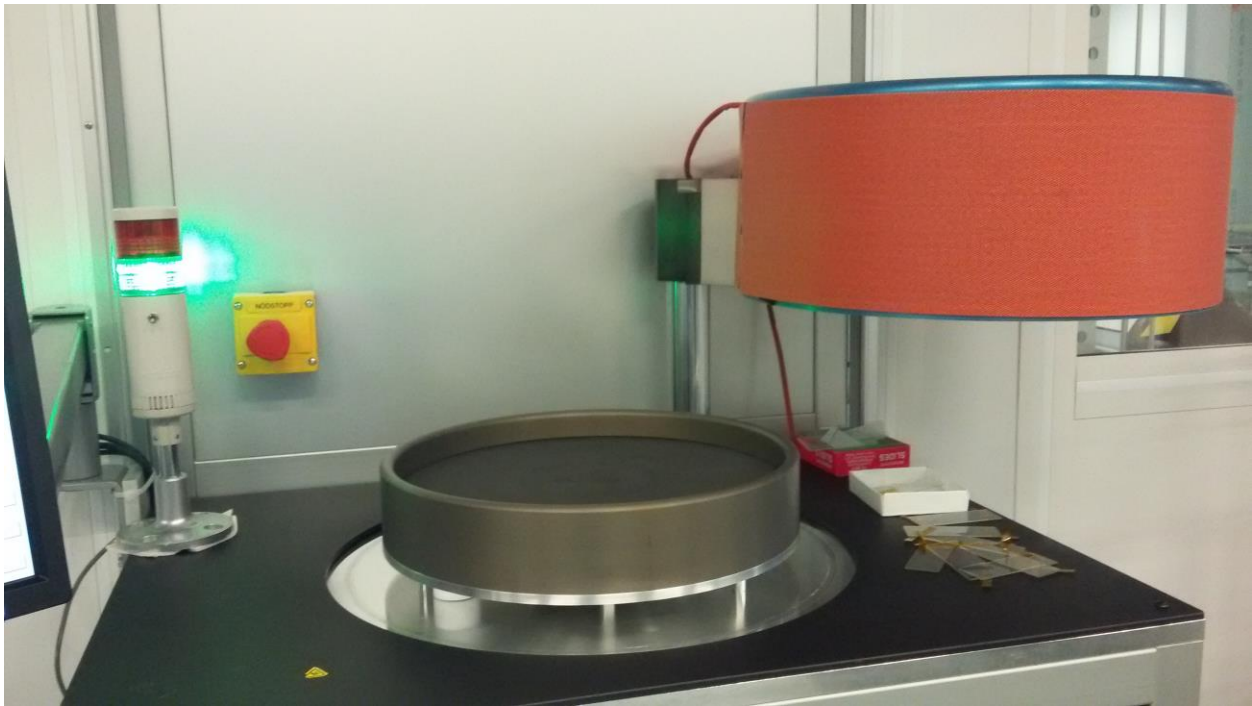
b. Loading samples

1. Click on “VENT” button on the left side of the screen
2. Once the system is vented, an “OPEN” button will appear on the left of the chamber diagram. Click on the “OPEN” button.

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3. After the chamber lid lifts up, it will swing to the right and then come to a stop.

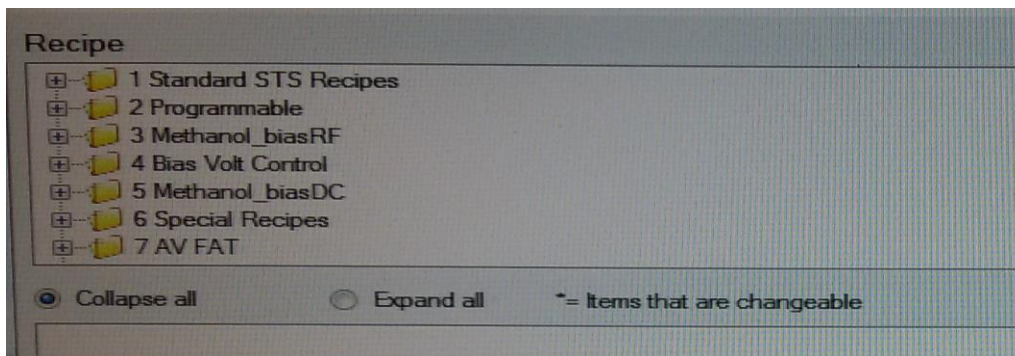


4. Load your samples directly on the graphite chuck. Place glass slides along the sides of your sample(s) if you don't want your samples to shift extensively during pump down. The glass slides can be adhered to the chuck with Kapton tape.
5. Click on the "CLOSE" button situated on the screen on the left side of the chamber diagram. A message will pop-up asking you to "Ensure chamber is clear of obstructions". Click "CLOSE" to acknowledge the message. The chamber lid should now close automatically.

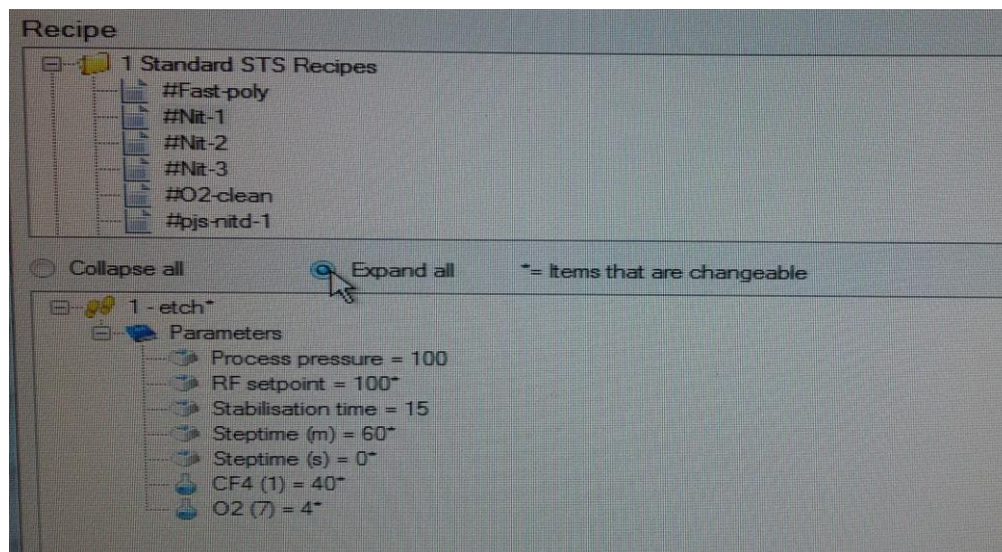
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c. Running a process

1. After closing the lid, you have the option of clicking on “PUMPDOWN” or “START BATCH”. Click on the “START BATCH” button on the left side of the screen. Chamber pump down begins immediately (*if you use “PUMPDOWN” button make sure to wait until the turbo gate valve position shows 100%. This is indicated below the image of the main chamber in the software screen. Once the turbo gate valve position shows 100%, go ahead and proceed with starting the batch as usual.*)



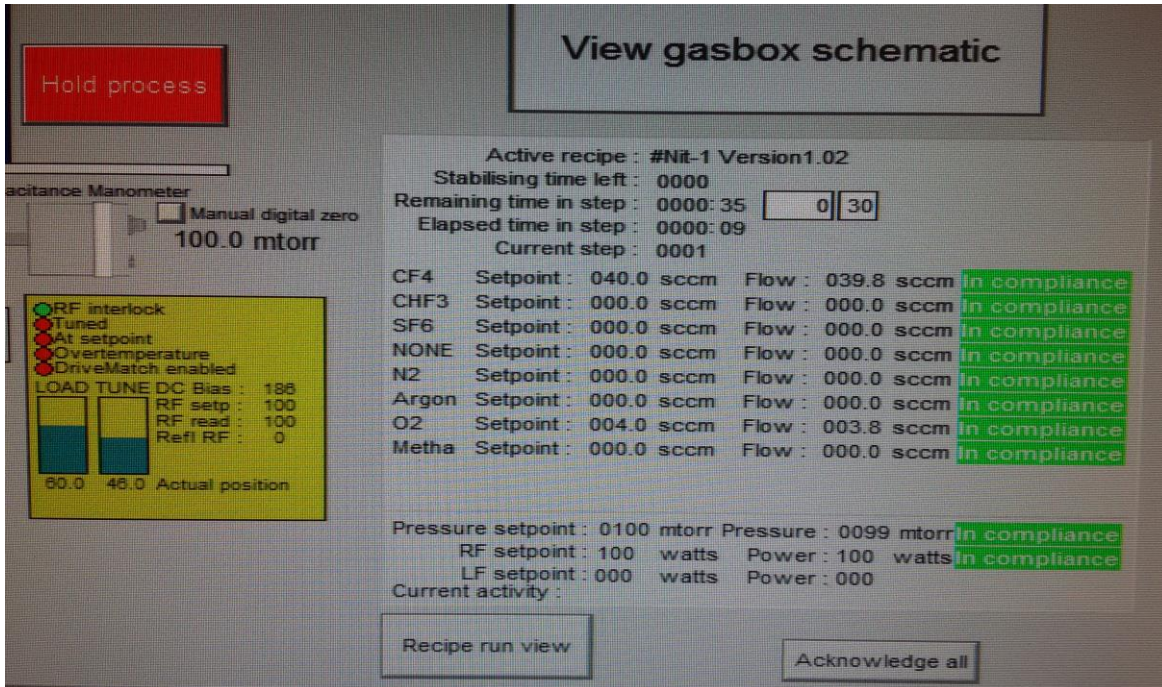
2. A recipe selection window will pop up allowing you to select the desired etch recipe from a list. Click on the “+” to expand the folder that contains the desired recipe, i.e. Standard STS recipes folder, Programmable folder, etc. In the selected folder, highlight the desired etch recipe, then move the cursor below and click on “Expand all”.



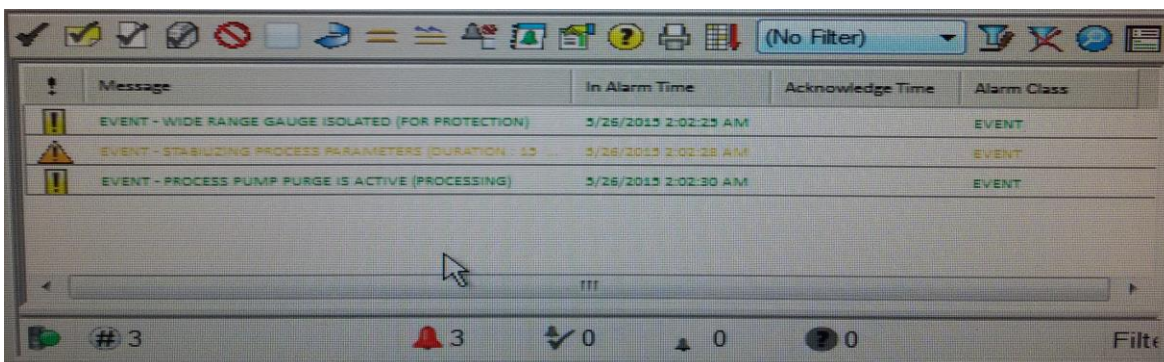
3. Modify the parameters as needed. To modify a parameter, double click on the parameter and then enter the new value. “step time” refers to the etch time. There are two boxes for “step time” (where m = minutes and s = seconds). Make sure to set the minutes “step time” to zero (0), if you will be etching for 59 seconds or less. Note that only parameters with a “*” mark next to them can be modified. Generally, process pressure and stabilization time cannot be modified.

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4. When done with modifying parameters, click “START”. The process will begin automatically. Gas flow and chamber pressure will stabilize within 15 seconds, and then RF will turn on and ignite plasma. A process countdown timer is displayed on the right side of the screen (as well as the feedback for the gas flow, pressure, power, etc). When the programmed step is complete, plasma will extinguish, process will end automatically and place the system in standby mode. A message will pop up that reads “PROCESS ENDED”. Click “OK” to acknowledge the message.



Note that if you want to abort the process before the timer goes to “0”, you can press the “ABORT” button on the left side of the screen. After a short time, a message will pop up that reads “PROCESS FAILED”. Click “OK” to acknowledge message. An event monitor on the lower right side indicates the status of any ongoing process at any time. In this case, it will indicate that the process error is due to the process being aborted.



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d. Unloading samples

1. Click on “VENT” button on the left side of the screen
2. Once the system is vented, an “OPEN” button will appear on the left of the chamber diagram. Click on the “OPEN” button.
3. After the chamber lid lifts up, it will swing to the right and then come to a stop.
4. Unload your samples
5. Click on the “CLOSE” button on the left side of the chamber diagram. A message will pop up asking you to “Ensure chamber is clear from obstructions”. Click “CLOSE” to acknowledge message. The chamber lid should now close automatically.
6. Click on the “PUMPDOWN” button situated on the left side of the screen

e. Logging off

1. On the lower-right side of the screen, click on “EXIT”.
2. Disable the “av-etch” using the MNC Badger system.

7. Trouble shooting

- a. Should you encounter a situation where the chamber pressure begins to rise beyond the setpoint and then soon after the system proceeds without plasma igniting or errors and goes on: “HOLD”, the best option is to abort the process, leave the system for a while (say 10 minutes or more), then retry your process. In most cases, the recipe runs normally again. This problem is being actively addressed and when fully resolved, the SOP will be updated.