Advanced Vacuum Vision 320 Operation Manual

The Advanced Vacuum Vision 320 is a manual load, parallel plate reactive ion etcher (RIE) configured for fluorine based etching. Etch gases connected to the system are CF_4, CHF_3, SF_6, Ar and O_2. Common materials etched in fluorine chemistries include silicon oxide (SiO_2), silicon nitride (Si_3N_4) isotropic etching of silicon and fluorine etchable metals. The platen is a 10” graphite plate capable of holding sample pieces up to a 10” substrate.

Training to Become a Qualified User

This tool requires a 45-minute training session for qualification.

Tool Start-Up

Note: You are not allowed to place any items on the top surface of the etcher. This prevents items from interfering with the opening and movement of the chamber and prevents the possible damaging the sealing surface of the chamber O-ring.

1. Verify the light tower.
    1. Red Light: A continuous Red light is displayed there is a problem with the system. The system must be reported as a Shutdown on Badger and the CNM2 staff notified.
        - Note: the Red light will flash along with a series of beeps at the end of each process.

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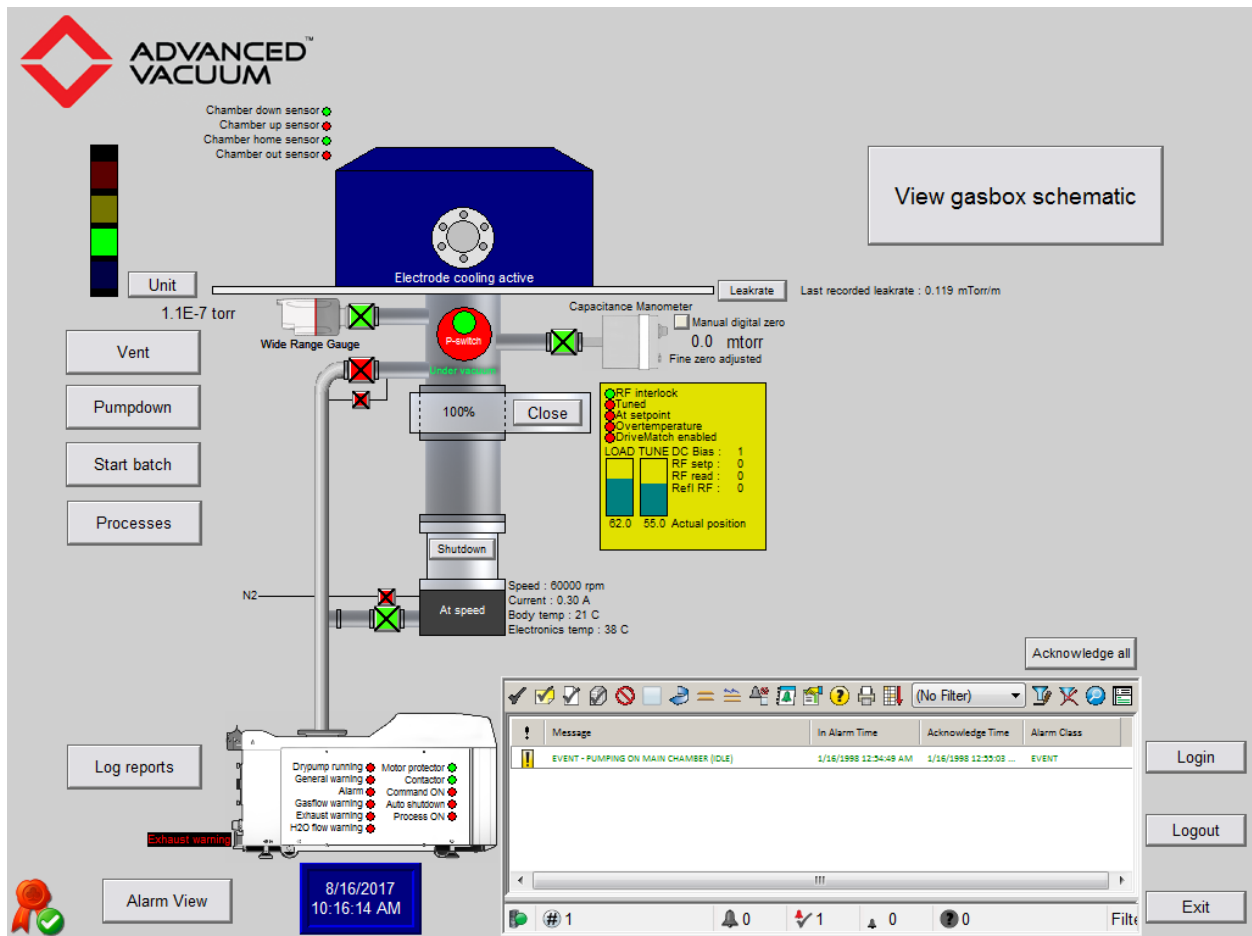
   2. Yellow Light: Flashes during chamber vent and becomes solid once the chamber has reached atmosphere.
   3. Green light: Flashes during chamber pump down and becomes solid once the chamber has reached the base pressure.
   4. Blue Light: A continuous Blue light indicates a process is running.
2. Review Badger for Shutdown, Problems and Comments. Verify there are no lab member reservations for the duration of your session.
3. Enable “Fluorine-RIE” on Badger.

Loading and Unloading a Sample

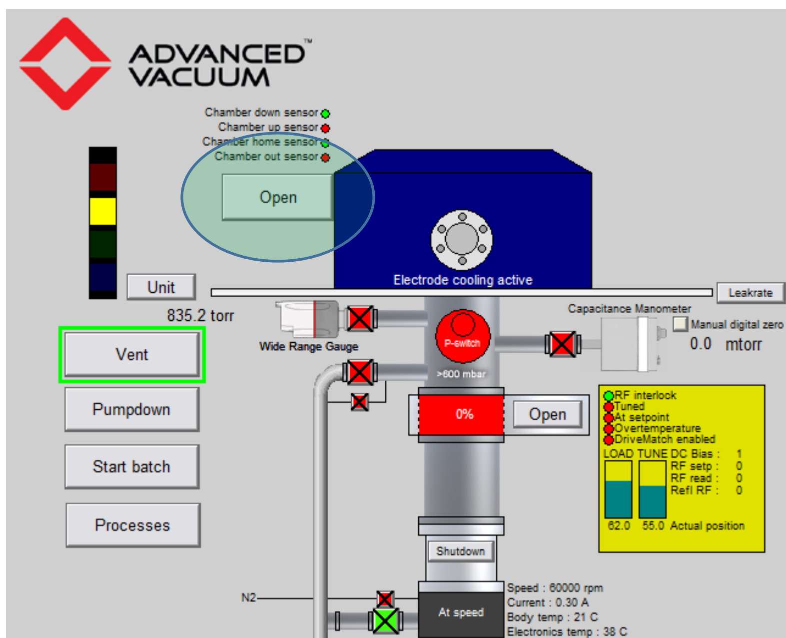
1. The Main Process Screen should always be displayed.
2. If the system has not enabled on Badger the keyboard will not function.



Main Process Screen

3. System Verification:
   1. Light tower is displaying continuous green.

   2. Verify there are no active Alarms.
      - If there are active alarms that can not be acknowledged, disable the tool on Badger, report the alarm as a problem and contact the CNM2 staff.
   3. The Wide Range Gauge is less than 5E-6 torr, for a chamber pumping longer than 10 minutes.
   4. The Turbo Pump is at 60,000 rpm.
   5. Throttle valve is open 100%.
4. If all the system verification checks are correct, vent the chamber by selecting the **Vent** icon.
   1. The Yellow tower light will blink during venting.
   2. Once the chamber has vent an **Open** icon will appear next to the chamber graphic.



   3. Select the **Open** icon. The chamber lid will raise and swing to the right of the system.

Note: You Must Wait until the chamber lid stops moving before you approach the chamber.

5. Using plastic tweezers, carefully load your sample on to the platen.

Note: the platen is graphite and is extremely easy to damage. Do not wipe down the platen.

6. Using a clean wipe, wipe down the O-ring surface and the sealing surface of the etch chamber.
   1. If there is any damage, on either the O-ring or sealing surface add this as a Problem in Bader and report it to the CNM2 staff.
7. Select the **Close** icon located next to the Chamber graphic.
   1. The chamber lid will swing back over the platen and lower to the seal position.
8. Once the chamber lid has stopped moving, select the **Pumpdown** icon to initiate the pumping process.

1. Note: The chamber will automatically pump down 2 minutes after being lowered.

Running a Recipe

The recipe file structure is not intuitive. Recipes are ran selecting a recipe Version using the Batch function. Any parameters which are variable must be defined so during the recipe writing. It is also dependent on the lab member to remember to select change these variables prior to initiating the Batch start. Once a recipe has been ran, using Batch it can no longer be modified without creating a new version. To modify the recipe you either need to copy and change the recipe name or you must create a new version. Making a change to a current recipe will automatically create a new version. Note, the recipe must be included in the Batch tree to be available to run. This is done by right clicking on the Settings and toggling the Batch button. The software likes to collapse the file structure, click on the Expand All for a more descriptive view of the files, Recipes and Versions and Settings.
NOTE: Do Not run any template recipes. These recipes are used only as starting points for creating new recipes.

1. Click on the **Process** icon from the main screen.
2. Expand the folders and files until you find your required recipe.
3. Highlight the required recipe by clicking on the **Recipe Title**.
4. Once the recipe is highlighted click on the **Start Batch** icon.
    1. A screen displaying the recipe steps will open. Parameters allowed to be changed are followed by an asterisk (*).
    2. Double click on the time parameters (minute and second) and change them to meet your process requirement.
5. Click **OK** once the etch time(s) have been changed.
6. Click **Start**.
7. The software will display the main screen, where you will need to click on the **Start Batch** icon.
8. Monitor and record the Forward Power, Reverse Power, DC Bias, etch pressure and gas flows.
    1. **Abort**: Select the Abort icon to stop all processing and terminates the etch recipe. The RF power and gas flow will be stopped and the chamber will be pumped down.
    2. **Process Hold**: The process hold stops the countdown timer for the process step. This will allow for additional etch time.
    3. **Skip Step**: This will safely move the etch process to the next step in the etch recipe.
9. Once the etch recipe has completed the light tower will blink Red and sound three short tones.
10. Follow the directions for unloading a sample provided above.

Tool Shut-Down

1. The chamber lid must be closed and the chamber pumped down to <1E-4 Torr.

2. Disable “Fluorine_RIE” on Badger
3. Report all ‘Shutdown’, ‘Problems’ or ‘Comments’ if problems were encountered during your session. Report any concerns to the CNM2 tool owner.

Error Recovery

If an error occurs, read the message. If it is safe to resume the recipe, acknowledge the alarm and hit the resume button. If the error is hardware related put the system down on Badger and inform the CNM2 staff.

Creating and Editing a Recipe

Create a folder for your and group all the recipes in this folder. The easiest way to create a recipe is by coping an existing recipe. The **Template** folder is contains standard recipes which should be used as a starting point.

1. From the main screen click on the **Process**. The two was to create a new recipe are:
    1. Copy and edit the template recipe,
    2. Or add a new recipe. If you chose to add a new recipe, you will need to input each recipe step manually.
2. Click on the **Expand All** icon and open the Template folder.

NOTE: do not modify the Template Recipes these are only for coping in to a new recipe.

3. Highlight the **Version (latest)**. Right mouse click and select **Copy Recipe**.
4. Highlight the folder where you want save the recipe, right mouse click and select **Paste Recipe**.
5. The file structure will go grey and a window will open allowing you to rename the recipe. Click on the **Save** icon.
6. Rename the recipe as all recipes must have a unique name even if they are located in different folders.
7. Highlight the target recipe and right mouse click and select **Edit Recipe**.
8. Click on the **Details** icon in the bayRecipe window. This will display all the steps and process set points for the recipe.
9. Steps: Are the process sequence of the recipe.
    1. There is no limit to the number of steps for a recipe.
    2. To add a step to the recipe, highlight a step and select from Add a new step, Delete step or Edit step.
    3. Note: The Step number and step name must be unique.
    4. Clicking **Ok** will embed your recipe parameters in to the General recipe and the default parameters. Note: the General recipe parameters can not be modified.
10. Parameters: are the recipe set point values for each step.

1. Parameters are provided through a pull down list. See Appendix below for the available parameters.
2. Select the required Parameter and enter the Set Value.
3. If the Parameter can be changed at the start of the Batch run, also click on the **Variable** button, then click the **Ok** icon.
4. Note: a Parameter can only be used once per step.
5. Add, Delete or Edit all the Parameters in the step(s).

Note: make sure you have selected the Batch option for your recipe. If you do not select this option, the recipe will not be available to run.

11. Click on the **Save** icon to save the changes to the recipe.

Reports

bayReport is used for searching and displaying any Batch information. Input the search criteria and click on the **Search** icon. Highlight the report of interest and click on the **Report** icon.

Appendix

1. Advanced Vacuum Vision 320 Configuration and Specifications
    1. Tool Specifications

Maximum Sample Size	10 inch diameter
Platen Temperature Range	5 ^oC to 40 ^oC
Total Gas Flow Range	10 to 150 sccm
RF Power Range	20 to 400 Watts
Maximum Reflected Power (% of Forward Power)	>5%

2. Available Process Parameters:

Parameter	Unit	Description
Process Time	m	Parameter step run time (minutes)
Process Time	s	Parameter step run time (seconds)
Stabilisation time	s	Holds the requested stabilization time for active step (seconds)
Process pressure	mTorr	Holds the process pressure
RF power	W	Holds requested RF power for plasma process
Start pressure	mTorr	Holds ignition pressure if low pressure plasma process is to be used.
End pressure	mTorr	Holds end pressure if low pressure plasma process is to be used.
Gasname(s)	sccm	Holds the requested process gas flow for the actual step.
DriveMatch	True/False	If true the system will drive tune and load to set point position.
Cload position	%	Holds the Cload position to drive to if DriveMatch is true.
Ctune position	%	Holds the Ctune position to drive to if DriveMatch is true.
DC bias	Vdc	Holds programmed DCbias. (will change RF power to meet bias set point).
Strike power	W	Holds programmed strike power level for DC bias control.
Etch rate	A/min	Holds determined etch rate (A/m), user imput.
Target depth	Ang	Holds target depth for a certain etch. Uses data from parameter Etch rate to determine process length.

Over etch	Ang	Holds over etch in Ang. For above Etch rate and Target depth parameters.
Base pressure	Torr	Holds requested base pressure (if lower than system base, this pressure will be aimed for prior to the process step starting).
Pump down	True/False	If true the system will perform a standard pump down step for the duration programmed (or base pressure programmed).
Purge	True/False	If true the system will perform a post-process purge cycle for the duration programmed.
Flush	True/False	If true the system will perform the flush cyclcle for flushed gas lines for the duration programmed.
Auto vent	True/False	If true the system will automatically bent after the process is **ready**
Auto open	True/False	If true the system will automatically open the chamber after the process is ready and the chamber has been vented (if Auto vent is not selected, Auto open will automatically invoke the Auto vent command to achieve Auto open).

3. SF6 Warning: High SF6 process pressures (>70 mTorr) lead to adverse DC Bias effects, effectively eliminating any DC Bias.