UC SANTA BARBARA
OASIS *Protofab*

GlenTech R3A Plasma Chamber **SOP#: OAS-PF-0710-00**

User Responsibility, Training, and Consequences of Misuse

OASIS prototyping facility, Protofab, operates as a shared research and prototyping facility. All users are expected to follow this SOP, facility policies, and applicable safety guidelines to ensure safe operation, equipment longevity, and equitable access for all users.

This SOP is not a substitute for hands-on training or tool qualification. Refer to User's Manual and Guides for details.
Users must complete required Protofab training and receive authorization prior to independent tool use. In the event of misuse, unintentional error, or non-compliance, corrective actions will be educational, proportional, and focused on preventing recurrence, taking into account the user's experience level and the nature of the issue.

Corrective actions may include:

- Clarification or coaching on proper tool use
- Additional training or temporary supervision
- Temporary suspension of independent tool access
- Restriction to supervised use until competency is re-established

Users may be held responsible for repair, cleaning, or downtime costs only in cases of negligence or repeated misuse.

1. Purpose

This Standard Operating Procedure (SOP) defines the safe and proper use of Yield Engineering GlenTech R3A Plasma Chamber. This equipment provides plasma treatments including routine cleaning, aggressive etching, and electron-free cleaning for sensitive components prior to assembly processes.

2. Scope

This SOP applies to standard methods of material. Non-standard methods and material are outside the scope of this SOP and require prior approval from Protofab staff.

2. Safety & EHS

- PPE such as protective eyewear is mandatory. Refer to facility rules for details.

- **RF Hazard:** Do not attempt to bypass door interlocks; high-frequency radiation is present during operation.
- **Pressurized Gas:** Follow safety measures pertaining to pressurized gas cylinder operating.
- **Vacuum Safety:** Ensure the chamber is fully vented before attempting to open the door.

3. System Overview

- Power Supply: 400W, 40Khz
- Chamber Size (W x D x H): 22 (56) x 22 (56) x 21 (53), in (cm)
- Sample Capacity: 2 shelves 14 x14 inches
- Up to two gas plasma cycle

4. Application (modes)

- Electron-free for cleaning sensitive electronics devices prior to wire bonding.
- Active for etching and surface modification prior to bonding.
- RIE for the most aggressive surface modification applications.

5. Pre-use checks (before every run)

1. Ensure the vacuum pump and the plasma system are powered and plugged.
2. Check the emergency stop button is not pressed. **If pressed, contact facility management without turning the system on.**
3. Verify process gases are available.
    - Compressed dry air for system operation, provided by facility.
    - Oxygen, supplied by pressurized cylinder.
    - Argon, supplied by pressurized cylinder.

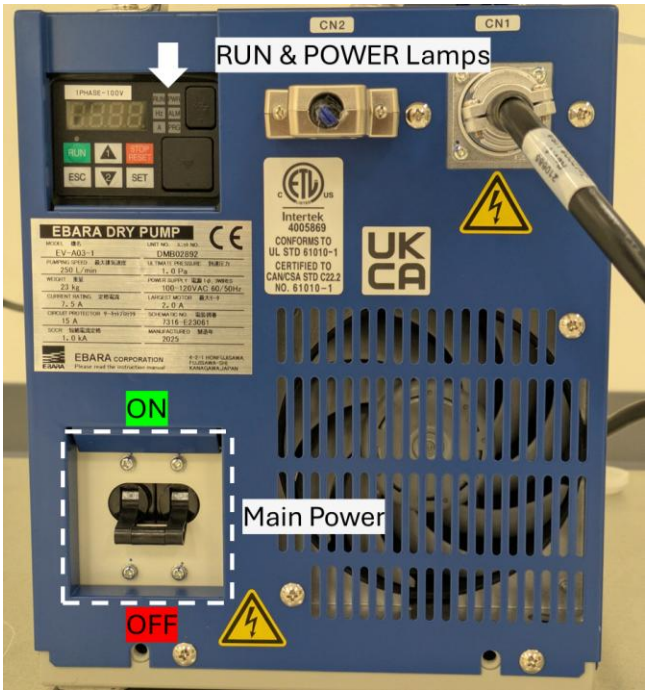
6. Standard operating procedure

6.1 Startup

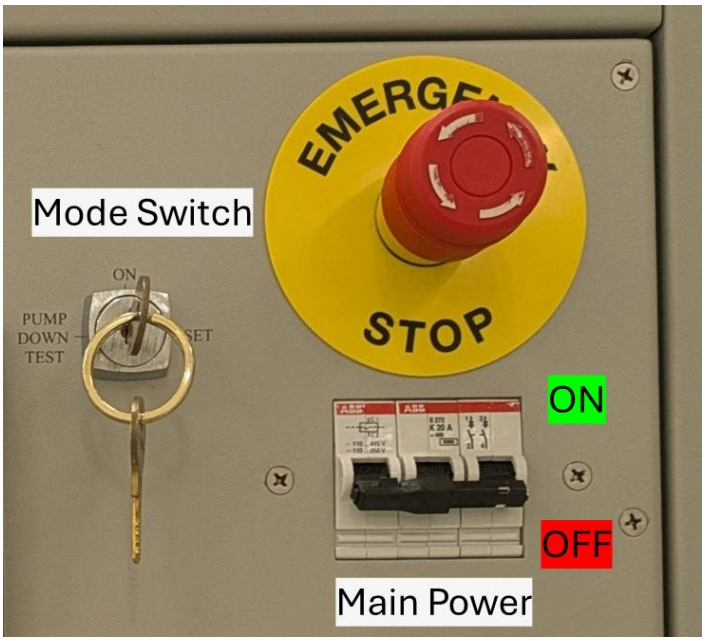
a) Gases: Open the cylinder(s) valve(s) and set the output pressure to 15-30 PSI.

b) Flow valves: Inspect the chamber's flow valves to be open. Avoid turning them.

c) Vacuum Pump: Switch on the MAIN POWER switch on the pump. The "RUN" and "POWER" lamps will come on. The acceleration will take a few seconds. Wait until the motor reaches to its stable condition.



d) System Controller: With the key in ON state, **s**witch on the system with the main power circuit breaker. Display will be illuminated.

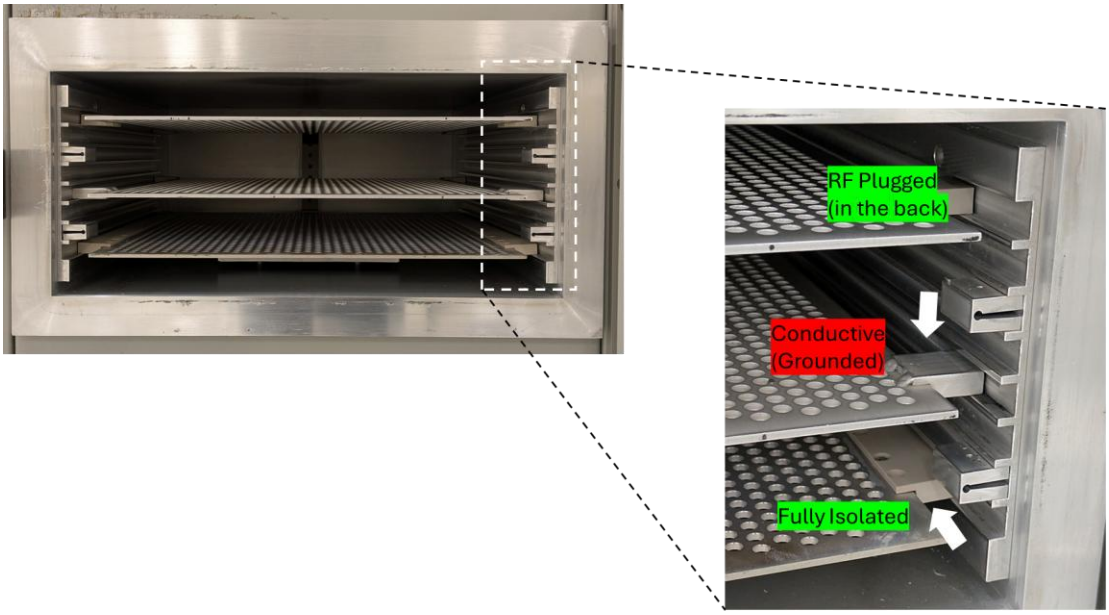


e) RF Generator: Switch on the system by the main power circuit breaker. Displays will be illuminated.

6.2 Operating Modes and Function

6.2.1 Function: System accepts two different plasma gases either for use in a two-sequence plasma cycle (GAS 1/A followed by GAS 2/B) or in individual single gas sequences.

6.2.2 Modes: The system provides quick interchange between plasma modes. Sliding and removable trays allow different configurations. Please note isolated or conductive trays.



Active Plasma Mode: This mode creates an electrical field directly between alternating trays to clean standard substrates.

Tray Setup	Connection Configuration	Sample Placement
Multiple trays possible	Connect alternating trays to the RF Power source and the Ground source (e.g., Tray 1 to RF, Tray 2 to Ground, Tray 3 to RF).	Place directly on any of the trays. Plasma will form in the gaps between them.

Downstream Mode (Shielded): This mode protects delicate, ESD-sensitive semiconductor components by keeping them out of the active electrical field.

Tray Setup	Connection Configuration	Sample Placement
You need a minimum of two trays: a top "shielding" tray and a lower sample tray in addition to powered tray.	Connect the upper tray to the Ground source. The RF power lead is connected to a dedicated electrode above the grounded tray.	Place your sensitive samples on the lowest tray, beneath the grounded tray.

Reactive Ion Etching (RIE) Model: This mode maximizes physical bombardment and directional etching by placing the sample directly on the powered electrode.

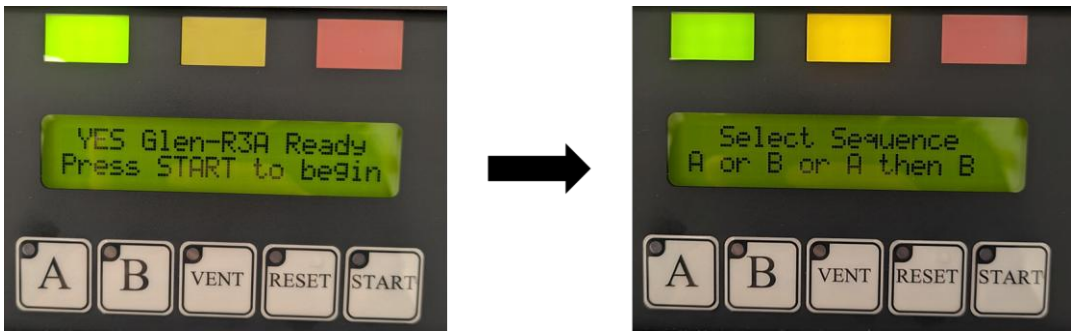
Tray Setup	Connection Configuration	Sample Placement
Use a single tray configuration or isolate the lower tray from the chamber walls.	Connect the tray holding sample directly to the RF Power lead. The top tray must be connected to Ground.	Place samples directly on the RF-powered tray. This creates a high negative bias that pulls ions straight down onto your substrate.

6.3 Operations

6.3.1 Standard Operating Flow

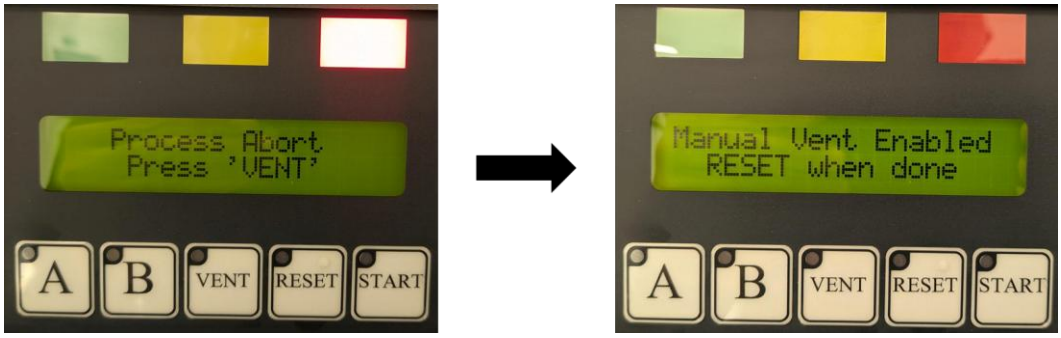
Follow Steps below to run. **Note: Mode Switch must be in "ON" mode.**

- From Home Screen, press "START" to enter sequence selection page. The yellow light will be blinking.



- For single gas A (Oxygen):
  i. Press A from sequence selection screen.
  ii. Press START.
- For single gas B (Argon):
  i. Press B from sequence selection screen.
  ii. Press START.
- For dual gas (A+B):
  i. Press A from sequence selection screen.
  ii. Press B from sequence selection screen.
  iii. Confirm the selection (A→B) by pressing START.
- To abort a sequence, follow the steps below:
  i. Press RESET. Process will abort with the red light blinking and beeping. Will be asked to enable venting. Red light will be blinking.
  ii. Press VENT. Chamber will start to vent.
  iii. Wait for the chamber to pressurized to atmospheric levels by following the "Vacuum Readout". It will be around 780 Torr.

iv. Press RESET when done.



6.4 Shut Down

a) Vacuum Pump: Press the "STOP/RESET" button and will notice a deceleration in the motor. Wait a few seconds until the cooling fan stops then turn off the main power.

b) System Controller: Simply switch if off by the main power circuit breaker.

c) RF Generator: Switch off the supply with the main power button.

7. Process recipes / parameters' Settings

Recipes for different materials and surfaces can be found on ProtoWiki. Here are steps to set recipe parameters.

7.1 Plasma Power Setting

Plasma power, which is set manually from plasma generator dial, applies to both gases and is not set digitally. If different for each gas, it must be adjusted prior to each cycle.

Note: Power should be adjusted when plasma is on (which is during cycles). Recommended to perform a dry run (empty chamber), monitor the power and adjust if needed.

i. Unlock the dial by turning the ring CCW.
ii. While generator is activated (plasma on) monitor will display power in KW.
iii. Turn the dial to achieve desired power. Maximum is 400W.
iv. Lock the dial (CW).

7.2 Timed and Duration Settings

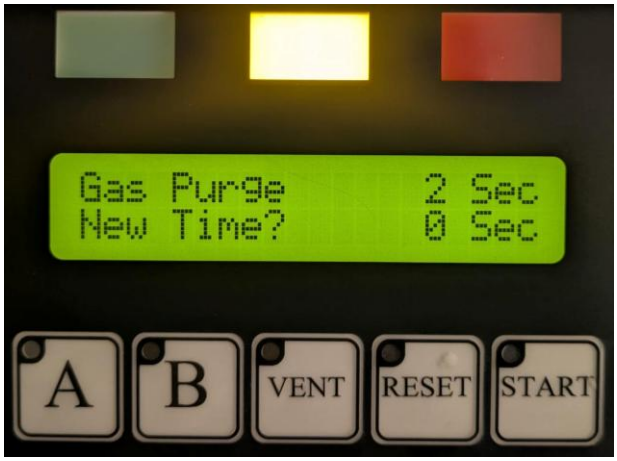
Follow Steps below to set plasma duration and chamber gas handling timings.

i. Turn the mode switch to SET state.

ii. Press A (Gas1, oxygen) or B (Gas2, argon) buttons for each recipe to edit.

iii. Set new “Pumpdown” duration in seconds using the keypad. Press ENTER. If default is acceptable skip the step by pressing A/B based on the program being edited. **The 150 seconds will take the chamber below 50mTorr.**

iv. Set gas purge duration in seconds. This refers to Gas 1 or 2 filling the chamber.



v. Set Plasma duration in seconds.

vi. Set chamber venting duration in seconds. 120 seconds is an optimum setting.

vii. Return the mode key to ON position.