CORAL Name: RIE-2Chamber-AMAT-P5000

Location: 6L, room 12-1110C
Purpose: Etching
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Introduction

The Applied Materials P5000 is a single platform, multi-chamber system. This system is configured with two Reactive Ion Etch (RIE) chambers which use a Radio Frequency (RF) energy created plasma. The RIE etch is enhanced by applying a rotating magnetic field to the plasma, which increases the residence time of free electrons in the plasma. This causes more collisions between the free electrons and the gas molecules, resulting in a more ionized and reactive gas.



Chamber A is a dielectric etch chamber using fluorine-based recipes, while chamber B is used to etch Silicon and related materials with primarily chlorine based recipes..

The system is completely controlled by a computer, and the wafers are transported via a robotic arm. The wafers are mechanically clamped onto the chamber electrode and Helium cooling is applied to the backside of the wafer to prevent resist burning and to maintain consistent wafer temperatures.

The front of the machine contains the cassette indexer, onto which two full cassettes of wafers may be loaded. The system identifies each individual wafer so that it will be returned to the correct cassette slot.

The robot loads up to 8 wafers at a time from the cassettes to the loadlock to minimize pump and vent cycles to improve throughput when running many wafers.

Safety

Hazards present on system are high voltage, RF radiation, and pressurized gases. Ar, N_2, CF_4, and CHF_3 can displace oxygen and cause rapid suffocation. Cl_2, HBr, and NF_3 are toxic if inhaled, Cl_2, NF_3 and O_2 are strong oxidizers and can cause or intensify a fire. Under normal operation the user is protected from these hazards by the tool panels and interlocks, and the Toxic Gas Monitoring System (TGMS). Do not attempt to open or remove any panels as you risk exposing yourself (and others) to these hazards.

Mechanical pinch/crush points exist with the loadlock lid and robot arm. Exercise care when loading/unloading samples and carriers from the loadlock.

If the tool is behaving dangerously or making loud noises, press the red EMO button, alert the staff, and shutdown the system on Coral. DO NOT attempt to re-energize the tool!

User Qualifications and Responsibilities

During training you will learn to run wafers in automatic mode and edit recipes. To be considered qualified you need to be trained by the staff in charge, be up to date with your safety trainings and have a PTC approved process. There are restrictions to what materials are allowed in the etch tool and what type of recipes can be run (see appendices). Circumventing these restrictions or running processes/materials that have not been approved by the PTC can lead to disqualification from the tool.

Users are expected to leave the system with a plastic cassette on each side of the cassette elevator before disengaging from CORAL.

If you encounter any problems while operating the machine, report them immediately in CORAL so that the staff can address them in a timely fashion.

Operating Procedures

Make CORAL reservations ahead of time for the RIE-2Chamber-AMAT-P5000. Verify that the system is not being used before you engage on CORAL. CORAL disables the gas box exhaust feedback, so you need to engage before you can run any recipes.

All user interaction with the software is done using a light pen and the CRT monitor. Using the button on the side of the light pen you can click on different fields on the screen. Doing so can bring up an on-screen keyboard or various lists or menus depending on context.

Confirm the system is in Manual mode

1. Go to **System->Control System**. Confirm that the System State field reads “Manual”. If it reads “Automatic” Click on **Wafer->Stop** in the navigation bar to make sure the wafer handler is idle, then click on the System State field and change it from “Automatic” to “Manual”.

Edit process recipe

2. Go to **Program->Process Program** and scroll through the list and select the recipe you want to run. This will show the recipe parameters. Edit the etch time as needed. If the existing processes don’t fit your needs, please discuss requirements/desired changes with the specialist in charge before modifying any process parameters to make sure that process stays within a safe operating regime for the tool.

Select etch sequence

3. On the **System->Control System** screen click the Wafer Process field for the appropriate chamber and scroll through the pop-up list and select the correct process recipe for that chamber, then click on the Wafer Process field again to confirm. For example, if running a native oxide breakthrough then a shallow silicon etch, select “5000:Ch A BT” for chamber A, and “5000:Ch B STI” for chamber B.

4. Click on the Sequence selection field and scroll through the popup list and select the sequence that uses the correct sequence of chambers for the etch. In this example, select “To A then B”. Click on the Sequence selection field again to confirm.

Load wafers

5. Go to the **Wafer->Monitor Wafers** screen and check the bottom of the screen to see the cassette you want to use is released. For example, to use cassette A, it should say "Release A" at the bottom of the screen. If not, click on "Clamp A" and select "Release A" from the pop-up menu and click "Release A" to confirm.

6. Remove the plastic cassette and load the wafers with flats oriented towards the open end (top) of the cassette. If the wafer flats are not aligned correctly you will have backside cooling Helium leak rate errors. Keep track of the slots the wafers are loaded into. Slot 1 is closest to the H-Bar. Take care not to cross-slot the wafers. Surface to be etched should be facing away from the H-bar.

7. Place the plastic cassette back into the loadlock. The H-bar should fit into the slot on the cassette elevator platform, and the open end of the cassette should face in towards the tool.

8. Clamp the cassette in place (e.g. click on "Release A" then select "Clamp A" from the pop-up menu, then click "Clamp A" to confirm).

9. Once the cassette is clamped in place, the system will show 25 wafers in the cassette on the screen. If the cassette shows up as empty, release and reposition the cassette and clamp again. Click on and delete wafers that are not present. If the system is expecting a wafer but encounters an empty slot, the system will delete the wafer from the cassette. Do not delete wafers that are present in the cassette, otherwise the system may try to put a wafer into a slot that is already occupied which could lead to damage to the wafers or the robot.

Run wafers

10. Go to the **System->Control System** screen and change the System State field from "Manual" to "Automatic".

11. Click on red "confirm wafer position" message at the bottom of the screen.

12. Click **Wafer->Run(Go)** to start the etching sequence. The system will load each wafer into the appropriate chamber(s) and run the recipes specified in the sequence.

13. When wafers have all completed processing, a blue "All processing of wafers is complete" message will appear at the top of the screen. Click on the message to silence the system.

Unload wafers

14. Click **Wafer->Stop**, then go to the **System->Control System** screen and change the System State field from "Automatic" to "Manual".

15. Click **Wafer->Open/Close Door** and wait for front panel to slide down.

16. Release the cassette that you ran (e.g. click on "Clamp A" and select "Release A" from the pop-up menu and click "Release A" to confirm.)

17. Once the cassette is released, remove the plastic cassette from the loadlock and unload wafers.

18. Place the empty plastic cassette back on the cassette elevator platform.

19. Disengage the RIE-2Chamber-AMAT-P5000 on Coral.

Appendices