RAPID THERMAL PROCESSOR (Annealsys AS-ONE)

Lab Manual

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Equipment Category: **Semi Clean B**
Gases available: Ar, O2, N2, FGA, …
Mass Flow Controller (MFC) Limit/Range: 2000 sccm
Materials allowed:

1. **Only sapphire, SiC and III-V substrates are allowed.**

Materials not allowed:

2. Processing of wafers having back-side metal deposition.
3. Organic material is not allowed.
4. Wafer with traces of Photoresist
5. Other than GaN samples, please contact the system owners if you have any confusion.
6. Si samples are not allowed. Samples processed in the GC tools are not allowed. In case of usage, approval is required from the process team and FIC.

CALIBRATION TABLES To be used (please do also note them on the latest log-book to verify):

1. Thermocouple calibration table:
2. For Susceptor:
3. PID table for Susceptor:

Limitations:

1. Maximum allowed temperature for Pyro 1 is up to 1000°C.
2. Higher temperature process should not be run for a long time. (e.g., 60 sec up to 799°C and 800- 1000°C for 30sec).
3. The power percentage should be kept to 12%.

Training Policy for RTP (Group IV):
Policy: Training is open for all CEN users.
Shadow training: To do a process or be with another user and go through the operating procedure if the user hasn't used the system for more than three months **(90 days)**.
Allowed break: **120 days**, after which you will have to give a re-authorization test.

Training Procedure:
For students/staff from the electrical Department:

1. User must register on the Slot booking module, and (s)he has to send a Training Request under Equipment usage form on the slot booking module.
2. Minimum watching three runs performed by an authorised user.
3. If the trainee is confident, then (s)he has to do two runs in the presence of an SO or Operator. One independent run, including making a new process recipe from the beginning in the presence of SO.

For students/staff from other Departments:

1. E-mail from the respective guide to the FIC, Lab manager, who will subsequently send it to SO for training.

Rest everything is the same as in the above one.

Procedure for the start-up:

Before entering the clean-room

1. Ask the facility to **Turn On Chiller** and the required gases.

In the clean room

1. Mandatory: Open the gas line: CDA, PN2, PN2 (Purge)
2. Open the required gas lines for the process.
3. First, switch on the main circuit breaker
4. Switch on the system circuit breaker at the back side of the RTP tool.
5. Open the Laptop (It will automatically turn on)
6. Switch on the RTP system by pressing the green button at the front.
7. Open AsOne software.
8. Now, give the user's login name and password.
9. Download the recipe and purge the system before opening the chamber.

For processes:

1. Put a quartz pin + susceptor.
2. Place the sample in the susceptor and cover it.
3. Close the Chamber and lock it by pressing the lock chamber in software.
4. Turn on the primary pump by pressing **Primary** in the pumping section.
5. Wait for the dotted line to disappear as indicated in the Pumping section. Once the dotted line disappears, we can turn on the turbo pump.
6. To turn on the Turbo pump, press **Secondary** in the Pumping section, followed by pressing **Start** in the Turbo pump section (**this is to be done only at the time of tool start**). Wait for the Turbo RPM to increase to **1500**.
7. Wait for the chamber process shown by Full Range to come in order of 1E-4 mbar.
8. Stop **pumping** in the chamber by pressing **Stop** in the Pumping section.
9. You can start the process now. In the Process section, select the recipe and download it. Click on the **Start process** to run the recipe. **(Do not run your process if RTP 2 is ON, the power line is shared).**
10. If you suspect anything went wrong, you can press **STOP Process** on As-One software.
11. After the process is completed, enter the manual mode and turn on **Cooling**. Also, do a cyclic turn-on of N2 purge while cooling by turning on the **PEV valve**.
12. The Pyro has a lower temperature resolution of 250 ^{o}C. So, it's compulsory to **wait for 20** mins after the process is complete before opening the chamber.
13. Now, open the chamber and unload the wafers.

If you have only one sample or all processes are finished:

I. Unload the susceptor & quartz pin from the chamber
II. Clean the chamber base and quartz window with a bit of IPA after reaching sufficiently low temperature near to room temperature.
III. Place the quartz pin and susceptor back in the chamber and close the chamber.
IV. Make an entry in the logbook for your process.

If you have another process:

14. Load the new sample.
15. Turn on the Primary pump by pressing **Primary** in the Pumping section.
16. Once the dotted line disappears, press **Secondary** in the Pumping section to connect the turbo to the chamber.
17. Wait for the chamber process shown by Full Range to come in order of 1E-4 mbar.
18. Now, **stop pumping** in the chamber by pressing **Stop** in the Pumping section.
19. Follow step 9 onward for further processing.

Shut down procedure

1. After cleaning the chamber and placing back the susceptor. Close the chamber.
2. Turn on the Primary pump by pressing **Primary** in the Pumping section.
3. Once the dotted line disappears, press **Secondary** in the Pumping section to connect the turbo to the chamber.
4. Wait for the chamber process shown by Full Range to come in order of 1E-4 mbar.
5. Now, **stop pumping** in the chamber by pressing **Stop** in the Pumping section.
6. To turn off the Turbo pump, press **Stop** in the Turbo pump section (**the turbo RPM will start decreasing).**
7. Log out the AsOne software. A message will pop up, “Turbo pump is running; it will be automatically stopped after an hour.” **Press Ok.**
8. Shut down the AsOne software and computer.
9. Now switch off the RTP tool by pressing the red button on the front. Then red light on the Alarm would glow, indicating everything is correct.
10. Now switch off the circuit breaker at the back-side of the RTP tool.
11. Close all the process gas valves and the water line valve.
12. Switch off the main circuit breaker.
13. Inform facility team to turn off the chiller and other utilities.

Shut down procedure in case of Power failure

1. If UPS is working, complete the running process recipe (if it is not too long) and follow the normal shut down procedure mentioned above.
2. If UPS is not working – 1. First, switch off the circuit breaker at the back of the tool. Close all the gases.
3. Switch off the main circuit-breaker of the tool.
4. If your sample is inside the chamber, then take your sample out when the power comes.

Extra Precautions to be taken (Mandatory) during and after Process:

1. Clean the chamber (the steel base and the quartz window) right after your process is over with a bit of IPA after the chamber is cooled down to room temperature.
2. Do not flow gas (or reduce flow to very low) during ramping up as there could be temperature non-uniformity.
3. In case of warnings/ errors encountered during the process, refer to the list of the common errors the manuals kept near the system. It includes a list of quick checks that could result in a particular warning/error.
4. Put the quartz pins inside the covers given every time after use.
5. The RTP is to be always used with susceptor as the calibration table is created for susceptor only.
6. There should be a minimum 20 min gap between two runs.

Violations:

1. Ramp rate for exceeding **25°C/sec**.
2. Maximum temperature of annealing for GaN should not exceed 1000°C.
3. Not entering in the log book after a process run.
4. Not cleaning the chamber before and after processing with IPA.
5. Higher temperature processes should not be run for a long time. (eg: 60sec up to 799C and 800-1000 for 30sec).

Violation Policy:

1. System mishandling would lead to DAC and re-authorization by undergoing the training procedure again.
2. Standard sample mishandling and using non-allowed materials would lead to debarring from using the system for 7 days.