



# IIT Bombay Nanofabrication Facility

**Tool Name: Rapid Thermal Processing (RTP) – Nano 2 Lab**

**Standard Operating System (SOP)**

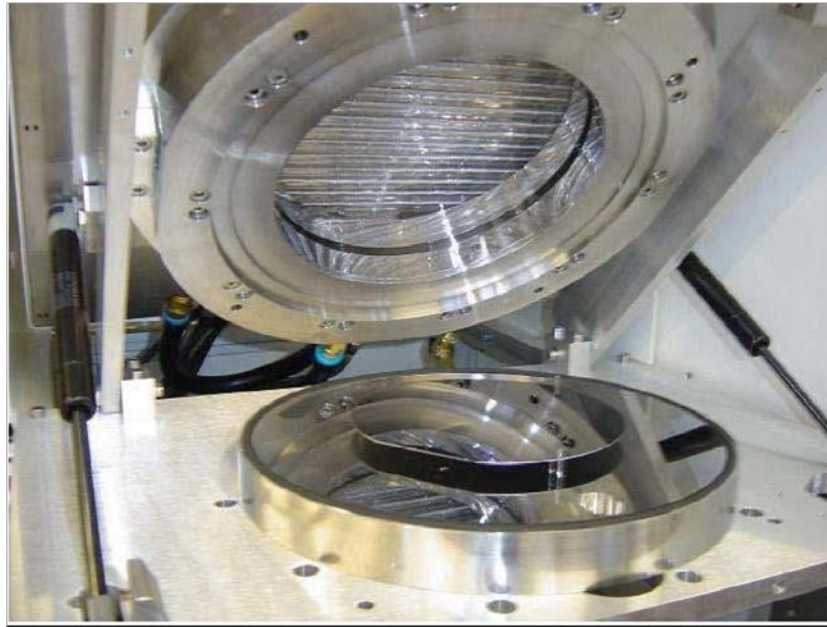
Updated On: 16<sup>th</sup> Oct 2023

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## Tool's Overview



*Fig.: Rapid Thermal Processor (Annealsys AS-ONE)*

### Checklist (Before starting the tool)

#### Material not allowed:

1. Processing of Si wafers having back-side metal deposition.
2. Organic material is not allowed.
3. Wafer with traces of Photoresist
4. Other than Si, Ge, GaAs, GaN, Sapphire, if you have any confusion, please contact the system owners.

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

**For Si**

<b>Thermocouple calibration table</b>	<b>TC1_Table</b>
<b>TC calibration table (HT)</b>	<b>PID control Parameter table</b>
<b>Pyrometer 1 calibration table</b>	<b>CAL-Si-PYRO-23-08-2023</b>
<b>PID control Parameter table</b>	<b>PID_Si_TC</b>

**For Susceptor**

<b>Thermocouple calibration table</b>	<b>TC1_Table</b>
<b>TC calibration table (HT)</b>	<b>TC2_Table</b>
<b>Pyrometer 1 calibration table</b>	<b>CAL-SU-PYRO-22-08-2023</b>
<b>PID control Parameter table</b>	<b>PID_SU_PYRO 22-08-2023</b>
Maximum allowed temperature	TC 1 = 1000°C (Max. time for 1 cycle is 30 secs. Max 4 cycles in one run)
	Pyro 1 = 850°C (Max. time for 1 cycle is 30 secs. Max 4 cycles in one run)
Maximum process time for single cycle	60s below 800°C process
	30s above 800°C process
Ramp Rate	Si →< 25 C°/s Susceptor →< 15 C°/s
For more than one cycle run, Ramp down temperature should be half of the desired temperature.	
Do not open the chamber above 50°C after the process	
Power percentage should not be used above 20%.	

## **Limitations:**

1. Maximum allowed temperature for TC is up to 1000°C and for Pyro 1 up to 850°C.
2. Higher temperature processes should not be run for a long time. (eg: 60 sec up to 799°C and 800-1000°C for 30sec).
3. TC temperature is up to 799°C for 60sec and 800-900°C for 30sec. for PYRO 1 temperature uses up to 799°C for 60sec and above 800 for 30sec.
4. Do not use the power percentages above 20 %.

## **Training Procedure:**

**(For student/staff from 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 authorized user
3. If the trainee is confident, then (s)he has to do two runs in the presence of an authorized user
4. One independent run including making a new process recipe from beginning in the presence of respective SO.




## **Procedure for start-up:**


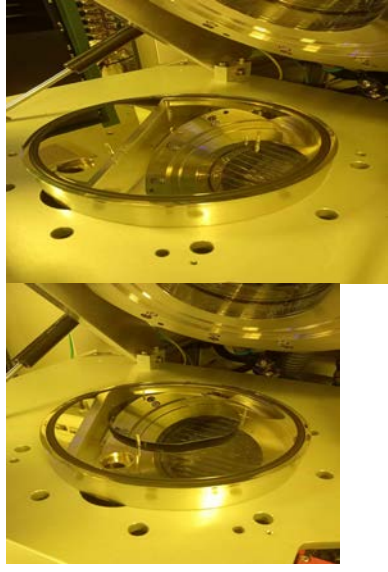
**Before entering the clean-room (Check with facility team)**


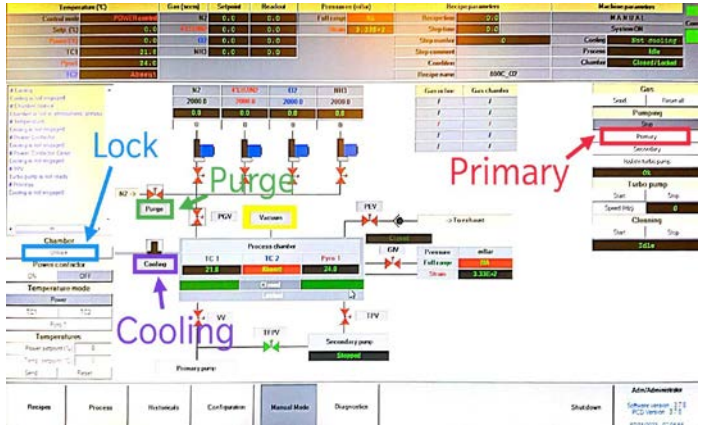
1. Check whether the chiller is working or not. Then open the water valve of the RTP tool and set it to 4 LPM.
2. Check PN2 pressure and set it to 4 bar.
3. Check whether the process gas you desire (O<sub>2</sub>, NH<sub>3</sub>) is open or not. Set it to 2 bar.
4. For the FGA (Forming Gas Annealing) process ask authorized facilities person to set pressure to 2 bar.

## Operating Steps:

1	Switch on RTP general circuit-breaker at the back side of the RTP tool.	 The image shows the back panel of a yellow RTP tool. It features a 'GENERAL CIRCUIT BREAKER' with a green indicator light and a yellow handle. Above the breaker is a 'WARNING Hazardous Voltage Enclosed' label with a lightning bolt symbol. Below the breaker is a technical specification label for 'ARWELSTS' and 'POWER CABLE' and 'PUMP CABLE' connection points.
2	Switch on the RTP system by pressing the green button at the front.	 The image shows the front panel of the RTP tool. It has a green button with a white vertical bar, a glowing blue LED strip, and a red panel with a yellow circle.
3	Switch on the laptop.	 The image is a solid grey rectangle, likely representing a redacted or missing image for the third step.

4	Open PN2, CDA and other process gas valves according to your requirement.	
5	Log on to the Laptop and open As One software.	
6	Now enter the login-name and the password.  Login Id: adm Password: aaaa	

7	Download a Recipe so that system starts initializing.	
8	Purges the system before opening the chamber. Clean chamber with IPA.	
9	Now put quartz pin + susceptor (not for Si wafers) and load GaN samples. Cover the susceptor with a lid.	
10	For Si wafers, put pins + 4" Si wafer and load Si carrier wafer and then place samples on the carrier wafer.	
11	Note that for Si wafers, the wafer should always be above and cover the TC cable. Close the chamber. Lock the chamber.	

12	Click on “Primary” to bring it in Vacuum (7.81 E-1 m bar) Now download the recipe and run the process.	
13	If you suspect anything went wrong you can press STOP Process on As-One software. E.g Power overshoots.	
14	After the process is complete purge the system	
15	If the temperature indicated in the pyrometer is above 50 deg C do manual cooling and do not open the system till temperature reaches 50 deg C.	
16	Purge the chamber to the atmosphere (1.00 E^3 m bar).	
17	Now open the chamber and unload the sample.	
18	Also unload the susceptor & quartz pin from the chamber.	
19	Unload 4” Si wafer in case of Si wafers.	
20	Clean the chamber base and quartz window with IPA after it has reached sufficiently low temp near to room temperature	
21	Make an entry in the log-book for your process.	