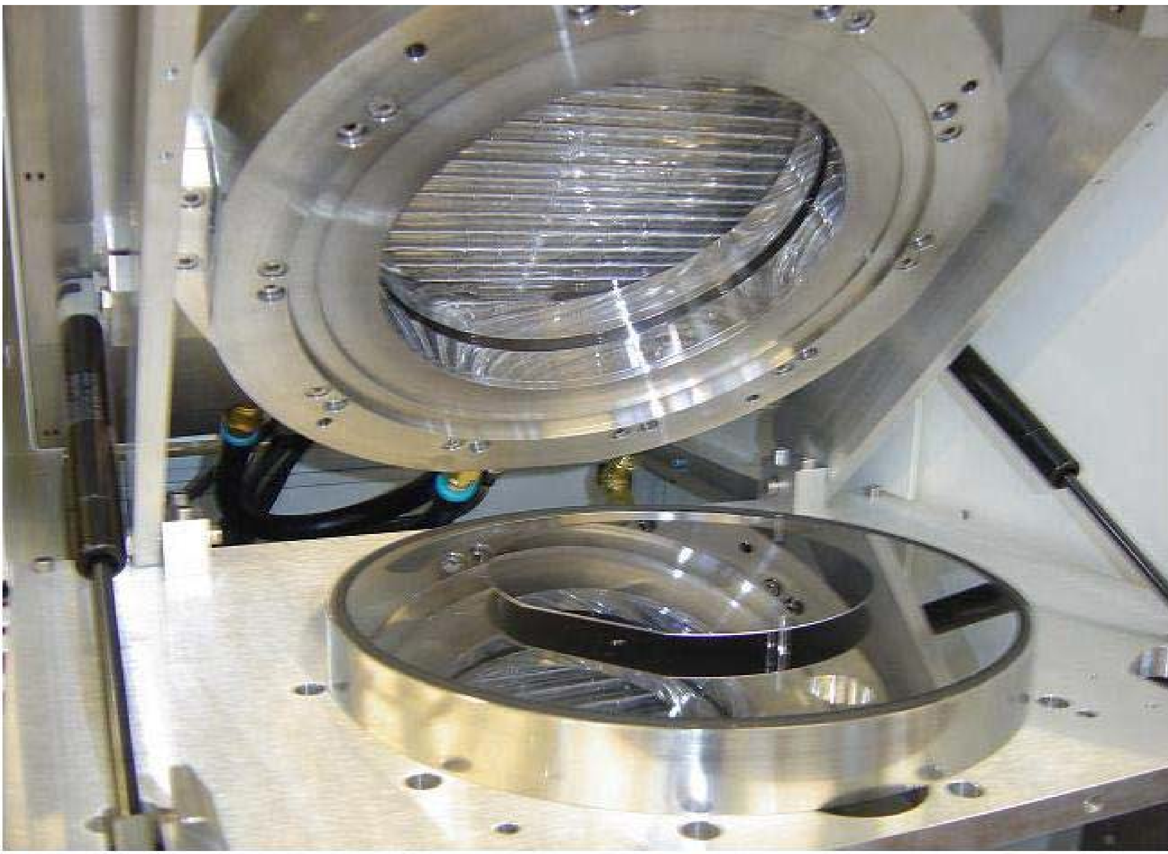
RAPID THERMAL PROCESSOR (Annealsys AS-ONE 150)

Lab Manual



Prepared by-

Hitesh Kamble

Akhil Kumar S

Materials 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 4” Si wafer or Pieces of 4” Si wafer: CALSI4HT_15032017 (PYRO1)

For 2” Si wafer or Pieces of 2” Si wafer: CALSI2HT_15032017 (PYRO1)

PID table for Si (PYRO1): SIPYHT

For Susceptors (Ge/ III-V): susceptor_cal_14032017 (PYRO 2)

PID table for Susceptor (PYRO2): SU150PY_BT_PID_slow2 (PYRO 2)

Limitations :

1. Higher temperature process should not be run for long time. (eg: 60sec upto 799C and 800-1050 for 30sec).

2. PYRO1 temperature uses up to 799C for 60sec and 800-1050 for 30sec.
   and PYRO2 temperature uses up to 799C for 60sec and 800-950 for 30sec.

Training Procedure:

For student/staff from electrical Department:

1. User must register on Slot booking module and (s)he has to send Training Request under Equipement usage form on 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 presence of an authorized user

4. One independent run including making a new process recipe from beginning in the presence of respective SO for Si and for III-V or Ge processing.

For student/staff from other Departments:

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

Rest everything is same as in the above one.

Procedure for start up:

Before entering the clean-room

1. Check whether the chiller is working or not. Then open the water valve of the RTP tool and RTP pump.
2. Check PN_2 pressure and set it to 4 bars.
3. Check whether the process gas you desire (O2 or Ar) is open or not. Set it to 2 bar.
4. For FGA(Forming Gas Annealing) process ask authorized facilities person to set pressure to 2bar.

In the clean room

1. First switch on the main-circuit breaker -> Pump circuit breaker -> Pump starter -> computer mains.
2. Switch on computer.
3. Open air-pressure valve and set it to 5 bars.
4. Open PN2 and other process gas valves.
5. Switch on the circuit-breaker at the back side of the RTP tool.
6. Switch on the RTP system by pressing the green button at the front.
7. Log on to computer and open AsOne software.
8. Now give the login-name and the password of the user.
9. Download the recipe and purge the system before opening the chamber.

For processes except FGA: (for FGA go to step 23)

10. Now put quartz pin + susceptor(not for Si wafers) and load your samples. Cover the susceptor with lid.
11. Note that for Si wafers , the wafer should always be above and cover the Pyro1 hole.
12. Close the chamber.
13. If samples are not smaller than 2”, then do cyclic purging-pumping a few times to remove traces of atmospheric environment inside.

    If samples are small, take few precautions which are mentioned in the extra precautions section below.
14. Now download the recipe and run the process. (**Do not run your process if ICPCVD process is going on**, as the N2 and power line is shared and they may have problems if RTP runs in parallel with their tool).
15. If you suspect anything went wrong you can press **STOP Process** on As-One software.
16. After the process is complete purge the system.
17. If any process was done, do cycles of purge and pump before opening the chamber.
18. If the temperature indicated in the pyrometer is above 50 degC do manual cooling and do not open system till temperature reaches 50 deg C.

19. Now open the chamber and unload the wafers.
20. Also unload the susceptor & quartz pin from the chamber
21. Clean the chamber base and quartz window with a bit of IPA after it has reached sufficiently low temp near to room temperature.
22. Make an entry in the log-book for your process.

FGA processing step :

23. Evacuate both FGA and Ar gas lines.
24. Turn on valve for FGA.
25. The gas inlet for FGA and Ar is common so ensure that Ar gas valve is OFF.
26. Follow step 10 onward for further processing

Shut down procedure

1. If you do not have more samples to process shut down AsOne software.
2. Shut-down computer.
3. Now switch off the RTP tool by pressing red button on the front. Then red light on Alarm would glow indicating everything is right.
4. Now switch off the circuit breaker at the back-side of the tool.
5. Close air-pressure and process gases valve.
6. Switch off the circuit breaker of the RTP pump and the RTP system.
7. Turn off the computer mains.
8. In the service corridor close water inlet valves of RTP tool and RTP pump.
9. If you were doing process in FGA ask authorized facilities people to close the cylinder valve), do not get it closed if it is currently in use on other systems.

Shut down procedure in case of Power failure

a. If UPS is working, then complete the process recipe (if it is not too long) that is running and follow normal shut down procedure as mentioned above.
b. If UPS is not working –
    1. First switch off the circuit breaker at the back of the tool .
    2. Close all the gases.
    3. Switch off the main circuit-breaker of the tool and pump.
    4. In case 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. Cleaning of the chamber (the steel base and the quartz window) right after your process is over with 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 even at 200sccm of flow inside the chamber.
3. Do not use metal tweezers on succeptors as they might aggravate the failure of succeptor by creation of pinholes. This could result in graphite dust contamination in the sample/chamber.
4. In case of warnings/ errors encountered during process, refer to the common errors list in the manuals kept near the system. It includes a list of quick checks that could result in a particular warning/error.
5. Put the quartz pins inside the covers given every time after use.
6. In case of small wafer piece samples:
    a. Do not include a pumping step in the recipe. The pumping line doesn’t have a control and pumps down the chamber very quickly which causes the samples to fly off from the pins many times.

b. After closing the chamber**, put the purge on and turn the pump on only a for a second. NOTE:** This'll help in pumping the chamber to base pressure. This if not met, might trigger an interlock and the process might not run until base pressure is reached. This is mainly a concern for small samples in which we don't put a pumping step in the recipe and directly fill the gas in. If error appears trying repeating the 1 sec pumping once more.

c. Keep the purge on for longer. This will do if the process is to be done in N2 ambient.

d. If the ambient is other than N2, and the intended ambient needs the previous gases to be removed from the chamber completely, then fill the gas in for atleast 2-3mins. This is to be followed even for larger samples when a particular ambient is needed for the process to attain more purity.

e. There should be minimum 20min gap between two runs in case of at higher temp annealing including in case of Pyro2 process wait until pyro2 reaches 50C.

Violations:

1) Ramp rate for Si processes could be max 80°C/sec while for susceptors should be less than 20°C/sec for better longevity of the same.
2) Maximum temperature of annealing for Si should not exceed 1050°C and for susceptors it should be below 900°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 process should not be run for long time. (eg: 60sec upto 799C and 800-1050 for 30sec).
6) PYRO1 temperature uses up to 799C for 60sec and 800-1050 for 30sec. and PYRO2 temperature uses up to 799C for 60sec and 800-950 for 30sec.

Violation Policy:

Violation on mishandling the tool would lead to suspension from using the system to suspension from the lab according to the problem caused.