

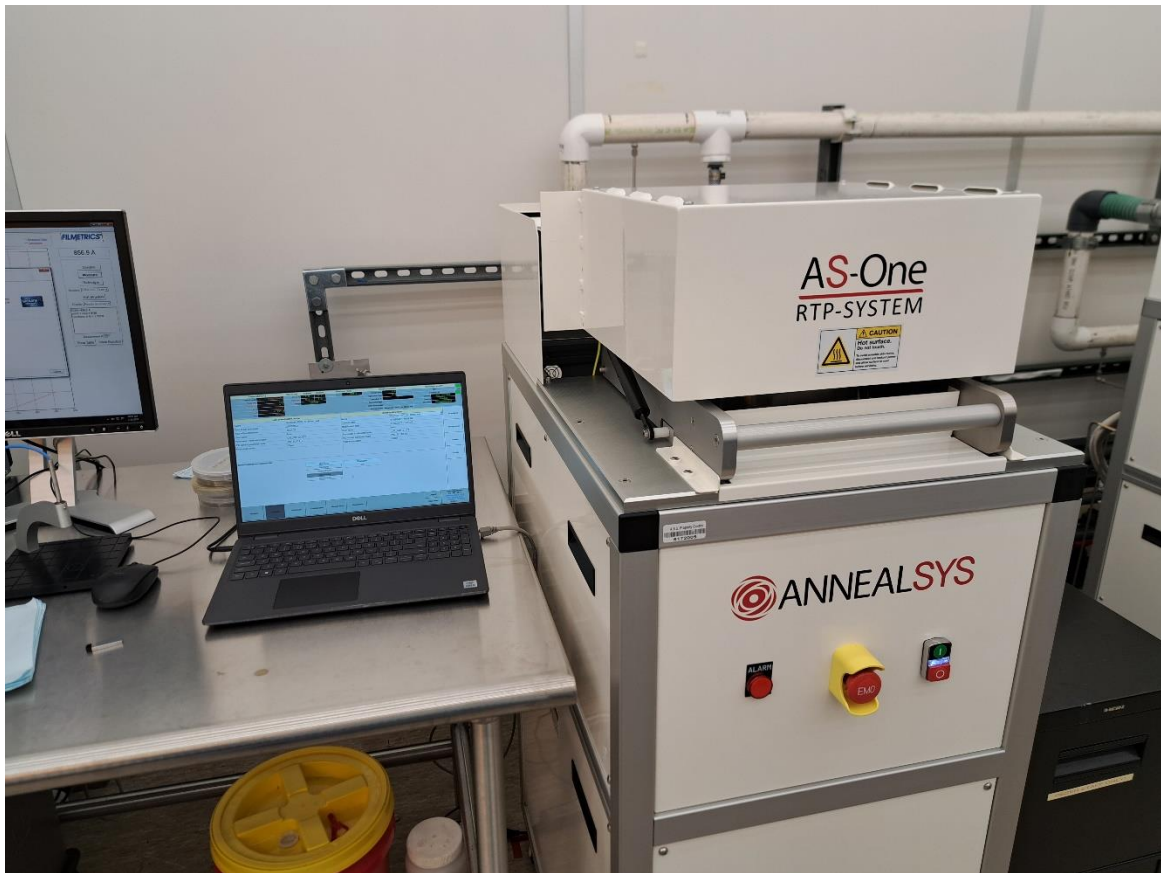
Arizona State University NanoFab

---

# AS-ONE100 RTP STANDARD OPERATION PROCEDURE

---

Rev B



## Table of Contents

### Contents

Table of Contents .....	1
1. Purpose / Scope.....	2
2. Reference Documents .....	2
3. Equipment / Supplies / Material .....	2
4. Safety .....	2
5. Set Up Procedures.....	3
6. Operation Procedures.....	4
7. Process Data.....	9
8. Revision History .....	10

## 1. Purpose / Scope

- 1.1. This document describes the procedures that must be followed to operate the AnnealSys AS-One 100 RTP (Rapid Thermal Process).
- 1.2. Tool Capabilities
  - 1.2.1. Substrates and materials. The AS-One100 is a general-use tool. However, material usage in this tool is still limited. Under no circumstance process material through this tool that has zinc, tin, indium, or compounds of these materials. Individuals found doing so will be responsible for replacing components thought to be contaminated.
  - 1.2.2. Sample sizes.
    - 1.2.2.1. Graphite susceptor will hold small pieces and substrates up to a 100mm in diameter and less than 1.5mm thick.
    - 1.2.2.2. Scroll Pump - The scroll pump pumps the chamber down to less than one (1) Torr. The pump is not used during anneal.
  - 1.2.3. Available Purge Gases.
    - 1.2.3.1. Argon or Nitrogen (Gas is selected using a hand-valve behind the tool)
    - 1.2.3.2. Forming gas (N<sub>2</sub> 95% / H<sub>2</sub> 5%)
  - 1.2.4. Allowable temperature range → 300 °C to 1000 °C.
    - 1.2.4.1. Maximum temperature ramp rate using a graphite susceptor is 20 °C/second.
    - 1.2.4.2. Maximum temperature ramp rate using a silicon wafer is 40 °C/second.
  - 1.2.5. Allowable Anneal Times
    - 1.2.5.1. 300 °C to 600 °C < 1 hour
    - 1.2.5.2. 600 °C to 800 °C < 30 minutes
    - 1.2.5.3. 800 °C to 1000 °C < 5 minutes.

## 2. Reference Documents

- 2.1. None

## 3. Equipment / Supplies / Material

- 3.1. Supplied PEEK tweezers.
  - 3.1.1. Do not remove PEEK tweezer from tool!
- 3.2. Use the appropriate non-metal tweezers to handle samples.

## 4. Safety

- 4.1. DO NOT leave the tool when running a recipe.
- 4.2. Burn Hazard

- 4.2.1. Substrate, susceptor and quartz window may be at elevated temperatures. Wait a sufficient cool down time before handling any material.

## 5. Set Up Procedures

- 5.1. If using nitrogen or argon, make sure the correct gas is set to flow.
  - 5.1.1. Go behind the tool and identify the arrow-shaped valve
  - 5.1.2. For N<sub>2</sub>, rotate the valve anti-clockwise until it is pointing down
  - 5.1.3. For Ar, rotate the valve clockwise until it is pointing up



Figure 1: Gas valve set for processing with N<sub>2</sub>

- 5.2. Launch the AnnealSys AS-One100 software by double clicking on the icon on the desktop.
  - 5.2.1. The icon is located on the Windows desktop.
  - 5.2.2. Enter your unique “Login Name” and “Password” than select “OK”.
    - 5.2.2.1. Do not share your login name and passwords with other users.
- 5.3. Annealsys software pages
  - 5.3.1. Recipes → Contain the recipe editor
  - 5.3.2. Process → Contain all the functions to operate the tool.
  - 5.3.3. Historical → All of your previous runs are archived here
  - 5.3.4. Configuration → Used by Staff ONLY

5.3.5. Manual Mode → Used by Staff ONLY

5.3.6. Diagnostics → Used by Staff ONLY

## 6. Operation Procedures

### 6.1. View, edit, and create recipes

6.1.1. Click on the “Recipes” page button at the bottom of the screen.

6.1.2. Click on “Header” on the right side of the screen.

6.1.3. At the “Recipe Name” section, select the recipe to view or edit.

6.1.4. When creating new recipes, edit an existing recipe instead of starting with a blank recipe.

6.1.5. Click on “Operations” on the right side of the screen to view steps.

6.1.6. Steps can be selected by clicking on them once and edited from the right panel.

6.1.7. “Delete” or “Insert” steps from the bottom panel

6.1.8. There are 7 types of steps.

6.1.8.1. RTP Temp → Controls lamp power and chamber temperature

6.1.8.2. Pumping → Enable or disable scroll pump

6.1.8.3. Gas → Change the flow rate of process gasses

6.1.8.4. Purge → Enable or disable flow of purge gas into the chamber

6.1.8.5. Condition → Do not proceed to next step until a condition is met.

6.1.8.6. Loop → Repeat from an earlier step a specified number of times

6.1.8.7. Macro → Execute another recipe. Macro recipes begin with the prefix “R-“

6.1.9. To view/edit the steps in a macro recipe without returning to the header section, double click on the macro step.

6.1.10. To return to editing the original recipe, click on “Back to recipe”

6.1.11. After making the desired changes, click on “Header” on the right side.

6.1.12. Click on “Save-as” to save as a new recipe or “Save” to overwrite the original recipe.

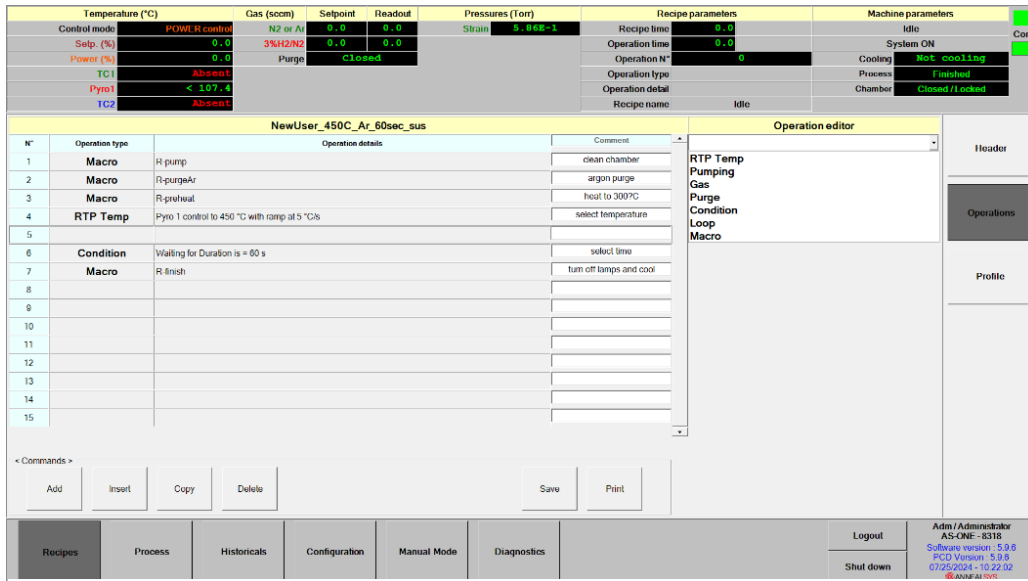
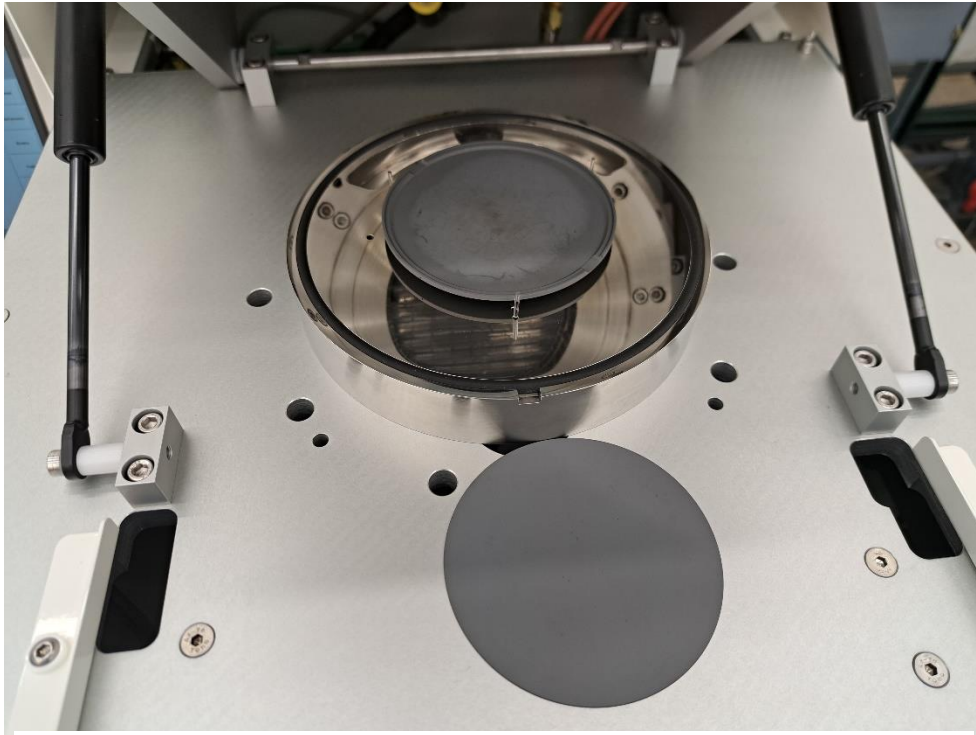


Figure 2: Recipe with blank step added

## 6.2. Load Sample

- 6.2.1. Ensure that the “Process” page is selected.
- 6.2.2. Select “Purge until ATM”. The Strain gauge pressure value will increase to approximately 760Torr.
- 6.2.3. Select “Purge” to keep continuous N2 purge.
- 6.2.4. Select “Unlock”. The unlock sequence only works if the chamber is at atmosphere. Listen for the sound of the unlock solenoid.
- 6.2.5. Carefully open the chamber by using the handle.
  - 6.2.5.1. Gently open the chamber all the way up.
- 6.2.6. Ensure that the susceptor is cool.
- 6.2.7. Remove susceptor lid and place it on the landing pad. (use the supplied tweezers)

NOTE: The susceptor is a very costly and fragile item. Handle it with care!



*Figure 3: Graphite susceptor with lid removed*

- 6.2.8. Place sample on the recessed area of the susceptor using non-metal tweezers.
- 6.2.9. Replace the susceptor lid. (Again, using the tweezers provided)
- 6.2.10. Slowly and carefully, close chamber using the handle.
- 6.2.11. Turn “OFF” the purge.
- 6.2.12. “Lock” the chamber lid.
- 6.2.13. “Pump” the chamber down. It should eventually go below one (1) Torr. If it does not, please make sure the purge is “OFF”.

### 6.3. Process Sample

- 6.3.1. Still under the “Process” page, select a recipe “Name”.
- 6.3.2. Press “Download” and wait for a “Downloading was successful” message.
- 6.3.3. Press “Start Process”.
- 6.3.4. A window will open displaying the historical data filename. Do not change the filename. Enter comments as desired in the “Historical comment” section.
- 6.3.5. Press “Start” to begin processing

6.3.6. A graph will appear showing process conditions, such as temperature, gas, or pressure. Monitor the conditions to make sure the tool is operating correctly. Do Not “Skip” any steps.

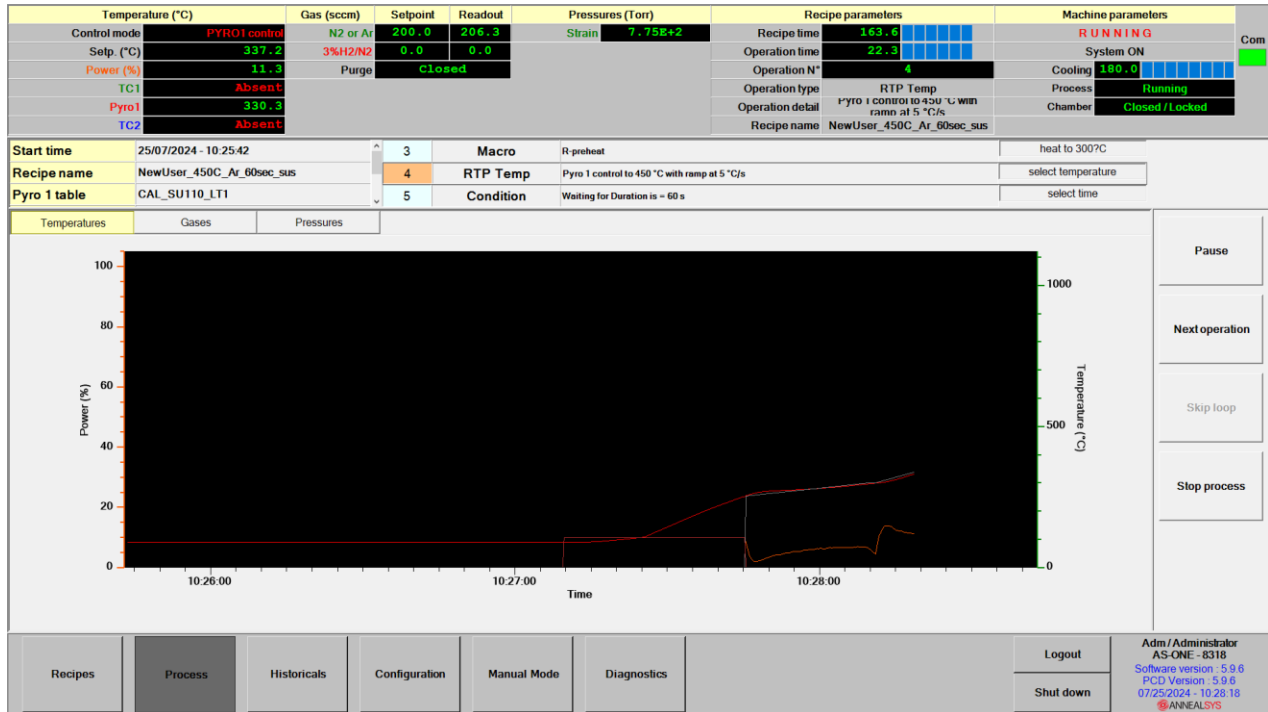


Figure 4: Recipe in progress

6.3.7. A “Finished” message will be displayed when the recipe has completed.

6.3.8. Select “OK”.

6.4. Unload Sample

6.4.1. Ensure that the “Process” page is selected.

6.4.2. Select “Purge until ATM”. The Strain gauge pressure value will increase to approximately 760Torr.

6.4.3. Select “Purge” to keep continuous N2 purge.

6.4.4. Select “Unlock”. The unlock sequence only works if the chamber is at atmosphere. Listen for the sound of the unlock solenoid.

6.4.5. Carefully open the chamber up by the handle. Lift it until it goes all the way up.

6.4.6. Ensure that the susceptor’s temperature is low enough to be handled safely using the supplied PEEK tweezers.

6.4.7. Remove susceptor lid and place it on the landing pad. Again, using the supplied tweezers.

6.4.8. Remove the sample(s) on the susceptor.

6.4.9. Replace the susceptor lid. (use the tweezers provide)



6.4.10. Carefully close chamber lid, using the handle.

6.5. Shutdown

6.5.1. Turn “OFF” the purge.

6.5.2. “Lock” the chamber lid.

6.5.3. “Pump” the chamber down. It should eventually go below one (1) Torr. If it does not, please make sure the purge is “OFF”.

6.5.4. Still under the “Process” page, select the “Idle” recipe.

6.5.5. Press “Download” and wait for a “Downloading was successful” message.

6.5.6. Press “Start Process”.

6.5.7. A window will open displaying the historical data filename. Do not change the filename.

6.5.8. Press “Start” to begin processing

6.5.9. A “Finished” message will be displayed when the recipe has completed.

6.5.10. Select “OK”.

6.5.11. Press the “Log Out” button to return to the login screen.



Figure 5: Login screen

## 7. Process Data

### 7.1. New User Recipe List

Name Idle	Operation Type	Operation Details
1	pumping	Start
2	condition	Wait for 30 seconds
3	pumping	Stop

#### R-finish

1	RTP Temp	Power control to 0%
2	Condition	Wait for Pyro 1 < 200 °C

#### R-preheat

1	RTP Temp	Power control 10% and Pyro1 > 250 °C
2	RTP Temp	Pyro 1 control to 300 °C with ramp of 2 °C/s
3	Condition	Wait for 1 second

#### R-pump

1	Purge	OFF
2	Pump	Start
3	condition	Wait for 30 seconds
4	condition	Wait for Chamber Pressure < 1 Torr
5	pumping	Stop

#### R-purgeXX

XX designates the gas species: Ar, N2/H2, or N2

1	pumping	Stop
2	gas	XX set point to 1000 sccm, ramp 5s
3	condition	Wait for atmosphere
4	gas	XX set point to 200 sccm, ramp 5s
5	condition	Wait for 10 seconds

#### template XX SUS

XX designates the gas species: Ar, N2/H2, or N2

1	R-pump	Macro
2	R-purgeXX	Macro
3	R-preheat	Macro
4	RTP Temp	Select temperature
5	condition	Select time
6	R-finish	Macro

### Revision History

Effective Date	Originator	DESCRIPTION OF REVISION	Issue
1/26/22	Kevin Hilgers	Initial Release	A
7/26/24	Carson Gockley	Added photos and instruction for editing recipes. Updated shutdown procedures to include idle recipe	B
		.	C
			D
			E
			F
			G
			H