Tool Owner: Ana Cohen, coana@seas.upenn.edu
Tool Backup: David Barth, dsbarth@seas.upenn.edu

# Standard Operating Procedure (SOP)

## CEE Apogee Spinner

## (SPN-xx)

*In case of fire or injury please call 911 (511 from campus phones)*

**If there is an unexpected error on the system/tool please report it in NEMO, and staff will address it**

**Please *DO NOT* run diagnosis without staff approval**

## Critical Information and Common Problems

1) **Select the correct spinner for your materials.** Cross-contamination can ruin lithography.
2) **Pick the correct size chuck for your sample**! If too big a chuck, resist is pulled in by vacuum – clogging chucks and vacuum line – causing the tool to stop working correctly.
3) **Do not force chuck on base or on spindle!** Using extra force will destroy the plastic parts. If anything does not fit together easily, something is wrong. Remove and try again.
4) **Do not edit the standard staff recipes.** You may use these recipes as is, or you may edit a user recipe with your desired parameters.
5) **Clean the spinner – including bowl, liner, lid, and chuck – immediately after spinning.** Use an acetone-soaked wipe. Do not spray solvent directly into spinner.
6) **Uniformity issues?** Make sure lid of spinner has all plugs in place.
7) **Vacuum issues?**
    - If vacuum does not pass the threshold, the chuck or substrate is causing the leak. Make sure both are clean, without scratches, and can lie flush together.
    - If enough vacuum but substrate isn't held, the chuck or vacuum line may be clogged. Report on NEMO.

Last modified: By Ana Cohen, 8/25/2025

# Training Videos:

Chuck Assembly

Chuck Installation

Using the Centering Device

Manual Resist Dispense

QNF Spinner Training**

**Please note that the spinners shown in this training video are the old ReynoldsTech spinners, but the overall process flow is still relevant. For any conflicting information, refer to and follow the most recent SOP.

- Primary tool owner: Ana Cohen, coana@seas.upenn.edu
- Backup owner: Taylor Noelle, noelle3@seas.upenn.edu
- QNF Process Team staff: qnf-process@lists.seas.upenn.edu

Feel free to contact the staff members with any questions about your process and the tool.

Problems with the tool ***MUST*** be reported on NEMO.
Do not contact QNF staff with tool issues directly.

# Procedure Overview

1. Log in
2. Set up recipe
3. Set up spinner bowl, chuck
4. Load the sample
5. Apply resist, run recipe
6. Clean-up

Appendices:

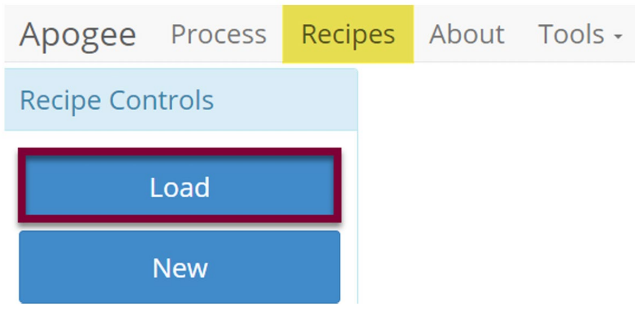
A. Chuck Sizing Guide
B. Approved Chemicals List
C. Cleaning Suggestions
D. Process Troubleshooting

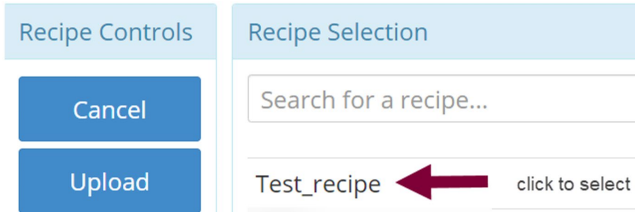
# Full procedure:

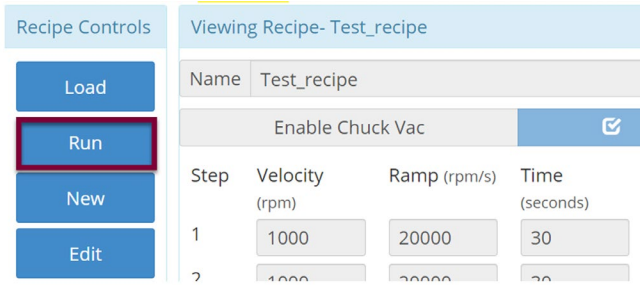
Log into the spinner via NEMO.

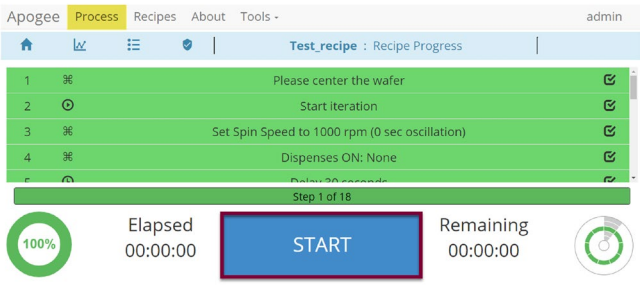
1. **Log in on the spinner touchscreen**
   - 1.1. Username: user
   - 1.2. Password: user

2. **Set up the spin recipe**
   - 2.1. Click on the “Recipes” tab at the top of the screen
   - 2.2. Click “Load” to access the recipes list.
   - 2.3. Click on a recipe to select. Standard recipes are marked “Ostaff” and should not be edited. These recipes run for 45s at the specified spin speed, with designated recipes including an initial 5s at 500 rpm as a dispersal step.
     - 2.3.1. If you need a different recipe, click on an available recipe.
     - 2.3.2. To create a new recipe, click “New”
     - 2.3.3. To edit, press “Edit” to edit both the name and parameters. When you’re done, save your recipe by pressing “Save”.
     - 2.3.4. Recipes can have multiple steps, so make sure all steps contain the desired parameters. You may add steps or remove unneeded steps.
   - 2.4. Click “Run” to set up your recipe, then click “Start” to initiate process.



**3. Set up the spinner bowl, chuck**

3.1. Every bowl should have a plastic liner installed. If it does not, report a problem on NEMO and do not use the spinner.

3.1.1. Staff will install aluminum foil around the liners of SPN-08 and SPN-09 to protect from epoxy

3.1.2. See appendix for recommended setup for easier resist cleanup

3.2. Select the appropriate chuck for your sample. The sample needs to cover the <u>whole</u> chuck, including o-rings. **See sizing guide in Appendix.**

3.2.1. Make sure the o-ring is installed, if needed. O-ring can be removed on the smallest chuck to fit <5mm piece parts.

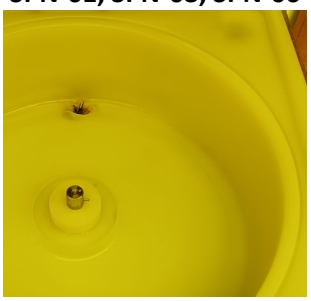
3.2.2. Chucks for 6" wafers are available. Contact staff for assistance.

3.3. Install the chuck on the spinner, aligning the spindle pin to the slot.

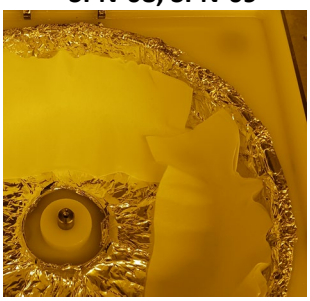
3.3.1. Piece part chucks share a base adaptor. Install the base first then screw chuck on. Make sure the base o-ring is installed. Take care not to cross the threads and only screw as tightly as the chuck allows.

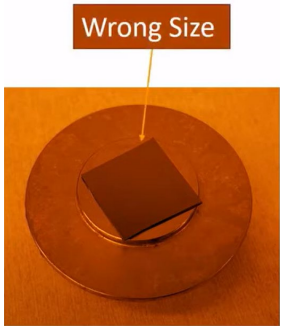
3.3.2. Do not force chuck onto spindle! These parts are plastic and easily deteriorate if abused.

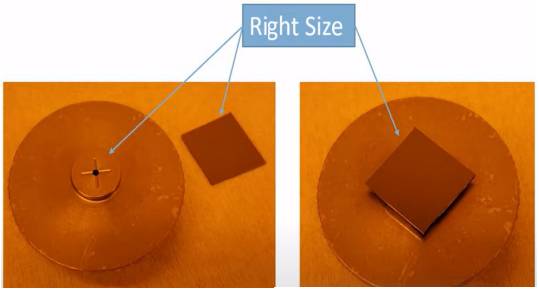
**SPN-01, SPN-03, SPN-06**



**SPN-08, SPN-09**






**4. Load the sample**

4.1. Place the sample on the chuck. Use the centering tool to place 4” wafers accurately.

4.2. Click on “Center” to check substrate positioning.

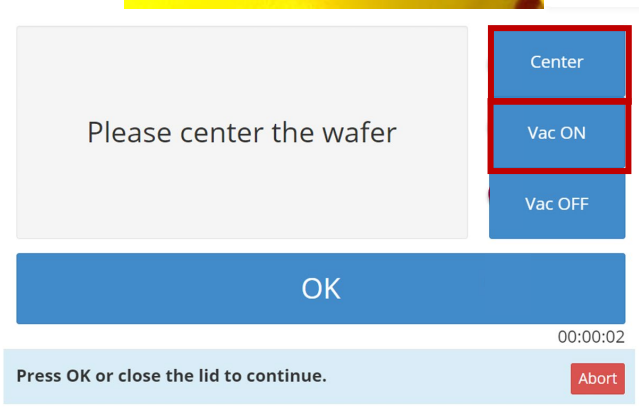
4.2.1. The chuck will rotate slowly with vacuum on.

4.2.2. If substrate appears to wobble during this step, is probably off-center. Reposition and check again.

4.2.3. Repeat as needed.

4.3. Once the substrate is centered, click on “Vac ON” to turn on the vacuum and hold it in place.

4.3.1. Check that substrate cannot be moved easily.




**5. Applying resist**

5.1. **Put on an extra pair of gloves.**

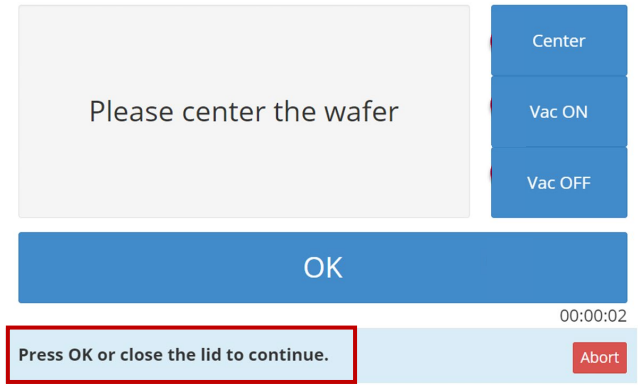
5.2. Open and dispense resist onto substrate.

5.2.1. Higher viscosity resists and/or larger substrates typically require a larger puddle to ensure full coverage.

5.2.2. Use the pipette to remove any air bubbles.

5.3. Press OK and close lid to start process.

5.4. After the spin is finished, open the lid and remove your sample.



**6. Clean up the spinner**

6.1. Gather acetone, IPA and wipes

6.2. Remove the chuck from the spinner and wipe down

6.2.1. Soak wipe with acetone. Do not spray acetone directly on chuck.

6.2.2. Once all residue is removed, wipe chuck with a new IPA-soaked wipe.

6.2.3. Replace clean chuck in box.

6.3. Remove the liner and wipe down spinner with acetone and IPA

6.3.1. Soak wipe. Do not spray solvents directly into spinner.

6.3.2. Make sure to wipe down both the spinner bowl and lid

6.4. Clean up the liner.

6.4.1. Close the lid to protect motor

6.4.2. Use dry wipes to collect fresh resist from liner

6.4.3. Use acetone and wipes to remove remaining material

6.4.4. Once clean, go over with a new IPA-soaked wipe.

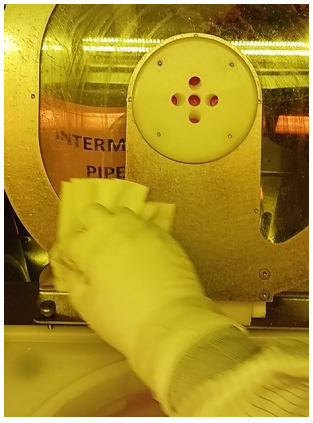
6.5. Cleanup should take ~2-5min for standard resist use and immediate cleanup. <u>Longer reservation times and multiple resist spins can increase the time needed</u>. See appendix for recommendations on resist cleanup

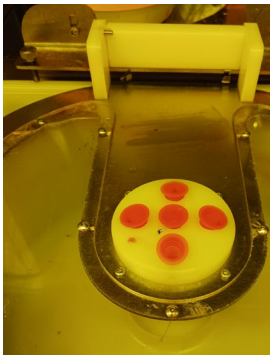
6.6. **Failure to properly clean spinners will result in loss of access!**

6.7. **If the liner and/or aluminum foil is badly damaged or dirty, report an error on NEMO. <u>Do not discard</u>.**

**All steps involve 2 wipe minimum!**

**1st – acetone** **2nd – IPA**

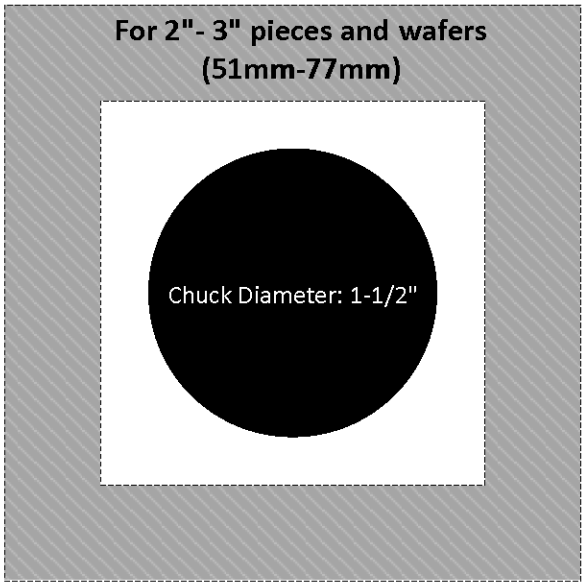


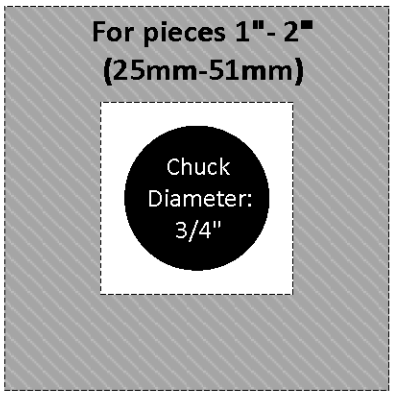



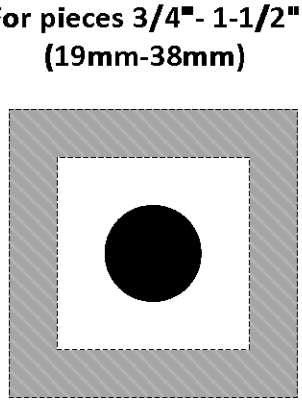
Log out of the tool via NEMO

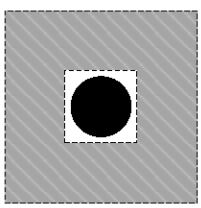
Always use a chuck diameter smaller than your substrate diameter!
For piece parts, the closest edge of your substrate should fall into the gray shaded area.







**Appendix A**

# Approved Chemicals for QNF Apogee Spinners

## **SPN-01:** Acetone Compatible/Soluble Photoresists

includes S18xx, SPR 220-x, AZ series, KL series, NR series, APOL-LO

## **SPN-03:** LOR, PMGI, Polyimide + SPN-01 Resists

Bilayer LOR process should be only done here!

## **SPN-06:** E-Beam Resists

includes PMMA A series, 1000 HARP series, ZEP520, HSQ

## **SPN-08:** Negative Epoxy Resists

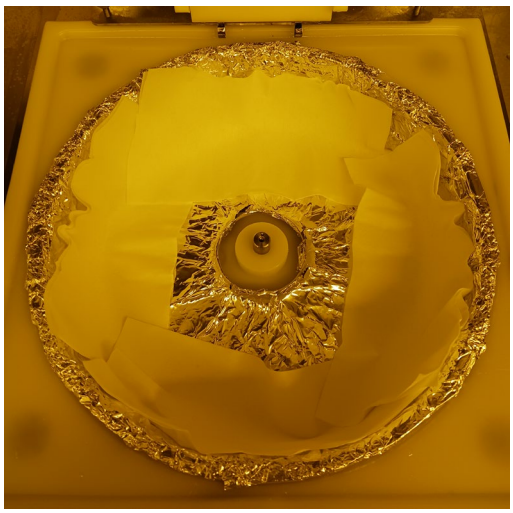
includes SU8, HARE SQ

## **SPN-09:** PDMS only

**If you are uncertain whether the resist you want to use falls into one of these categories, please contact the tool owner.**

**HMDS is not allowed in any of the QNF spinners.** HMDS vapor prime surface treatment in OVN-01 is standard practice due to safety and repeatability. Contact staff if you have any questions.

# Clean Up FAQs



**Thick resist in SPN-08 is so hard to clean up! What do I do?**

Before running the recipe, lay wipes down around the sides and bottom of the liner. This should catch the bulk of the resist. Afterwards, remove the liner from the spinner before removing the wipes to keep the spindle clean. Don't forget to wipe down everything else!

**After running multiple wafers, the resist dries up and it's harder to clean in the 5min you promised! Can I just leave it as is?**

The cleaning guideline of ~2-5min only applies to a single coat of one wafer. If acetone-soluble resist, it will come out, just with some extra elbow grease. To avoid this, wipe down the spinner between wafers and/or place wipes in the liner to shorten the final cleanup step.

**My resist seems to be glued to SPN-03 after spinning a bilayer with LOR. Help!**

LOR/PMGI are not acetone soluble and will be resistant to regular cleanup steps. Before using the acetone-soluble imaging resist, wipe down the spinner (lid + bowl + liner) with IPA. This is much easier if the resist is still wet. If the resist is dry, it can start to flake off if you work at it. If the resist is particularly difficult to remove, report on NEMO.

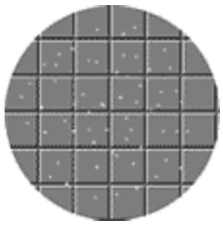
**I used to put aluminum foil in the spinners before, can I still do that?**

This is not generally approved due to the potential of foil getting caught in the spindle as well as the volume of waste generated. Please use one of the other recommended methods or contact staff.

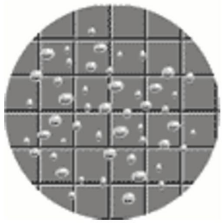
# Spin-Coating Process Troubleshooting

**Uncoated areas**
Insufficient dispense volume.

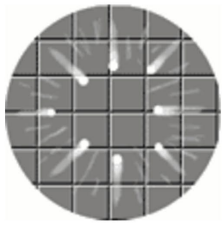
**Pinholes**
Air bubbles in dispensed fluid (resin).
Particles in dispensed fluid (resin).
Particles exist on substrate surface prior to dispense.



**Air Bubbles on Wafer Surface**
Air bubbles in dispensed fluid (resin).
Dispense tip is cut unevenly.



**Comets, streaks, or flares**
Resist sits on wafer too long prior to spin.
Spin speed and acceleration setting is too high.
Particles exist on substrate surface prior to dispense.
Fluid is not being dispensed at the center of the substrate surface.



**Swirl pattern**
Spin bowl exhaust rate is too high.
Fluid is striking substrate surface off center.
Spin speed and acceleration setting is too high.
Spin time too short.

**Film too Thick**
spin speed too low.....select higher speed
spin time too short.....increase time during high-speed step
exhaust volume too low.....adjust exhaust lid or house exhaust damper

**Film too Thin**
spin speed too high.....select lower speed
spin time too long.....decrease time during high-speed step