Arizona State University NanoFab

CEE COATER STANDARD OPERATION PROCEDURE

Rev B

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1. Purpose / Scope

1.1. This document covers the procedure that should be followed for normal operation of the Brewer Sciences Cee spinner/hotplate combo tool for the purpose of coating films that might be used for research purposes. This spin coat system is primary for support of the GCA Stepper and should only be used for spinning samples for that tool. If spin coating system is needed for samples other than those to be exposed on the stepper, priority must be given to the users scheduled for the stepper. It is suggested that you review this document thoroughly before proceeding with the operation of this tool & always check with staff when setting up a new recipe and/or coating a new material, to verify whether special precautions need to be taken for safety and compatibility. There are four levels of access to the system with a different passwords for each: Super User, Maintenance, Run/Edit recipes and Run only recipes. The Super User and Maintenance will be reserved for CSSER staff and as the user shows proficiency in using the tool, they will be granted an appropriate level of access.

Run Recipe user should be able to perform the following tasks:

1.1.1. Call up appropriate recipes
1.1.2. Configure spinner for substrates.
1.1.2.1. Understanding of "1st wafer effects" and impact on repeatability.
1.1.3. Operate spinner and hotplate in the proper sequence.
1.1.4. Utilize correct catch bowl for best spin results.
1.1.5. Proper cleaning of system when completed.

A Run/Edit Recipe user should additionally be able to perform:

1.1.6. Edit recipes and save them without overwriting existing recipes
1.1.7. Understand the effects of spin speed, spin time, and exhaust on the film quality
1.1.8. Understand the resist requirements for stepper lithography

2. Reference Documents

2.1. Chemical Safety & Hazardous Waste Management Rules & Procedures Handbook
2.2. If possible, the user should review the contents of the web page located at: http://www.brewerscience.com/research/processing-theory/spin-coating-theory to understand theory and issues related to spin coating photoresists on substrates.

3. Equipment / Supplies / Material

3.1. Photoresist or coating liquid.
3.1.1. Dispense apparatus; i.e., pipette, syringe, bottle, etc.
3.2. Substrates to be coated.
3.3. Dummy 4" wafer (if "1st wafer effects" need to be mitigated, see sec. 5.2.1.).
3.4. Appropriate catch tray
3.5. Acetone and IPA for cleaning

4. Safety

4.1. Ensure appropriate chemical safety guidelines have been satisfied for handling and dispensing solvents.

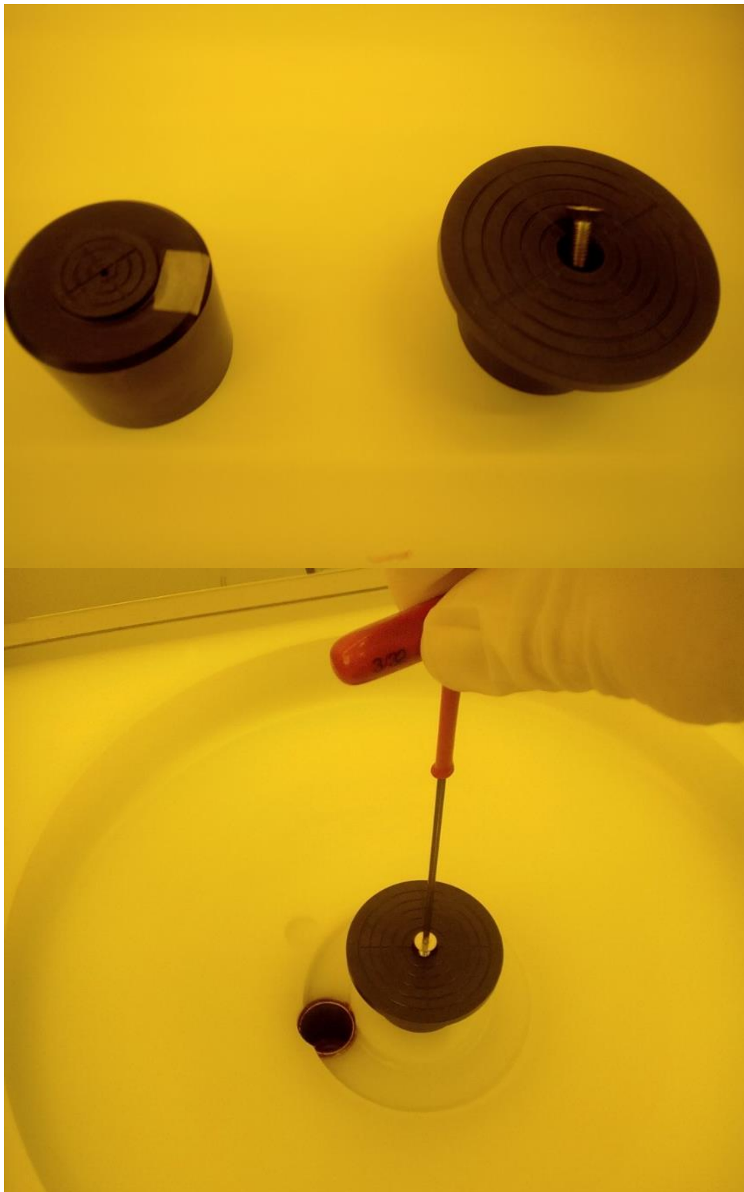
4.2. Observe appropriate equipment safety guidelines when working around the hotplate.

NOTE: If there are any problems with the coater, whether spinner module, hotplate module, or control computer, contact CSSER staff immediately. DO NOT attempt to repair the equipment without the approval of a Staff member.

5. Set Up Procedures

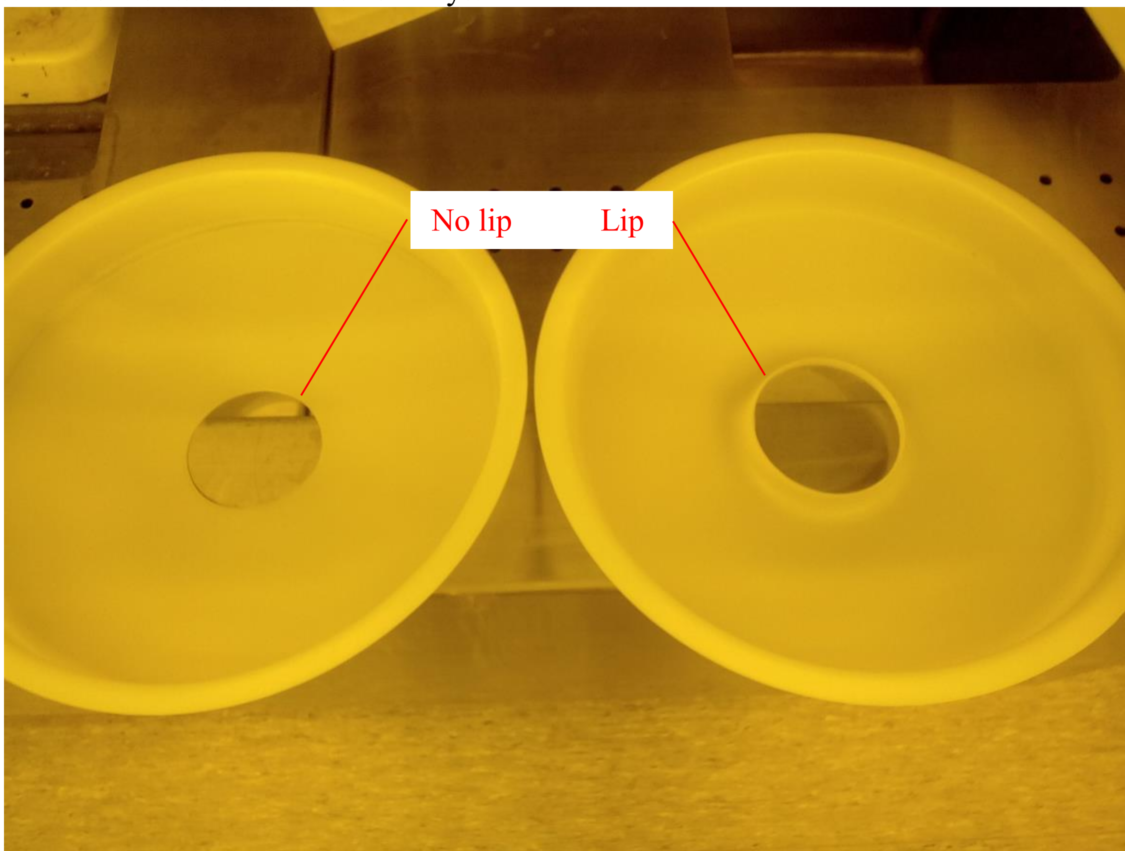
5.1. Attach appropriate size chuck for the substrate to be coated.

5.1.1. There are currently two chuck sizes for spinning samples. One for samples under 2" and one for 2" and larger. The larger chuck requires an attachment screw to hold it on the spindle. The small chuck just slips over the spindle. Both have a notch on the collar that must be indexed with the pin on the spindle shaft.

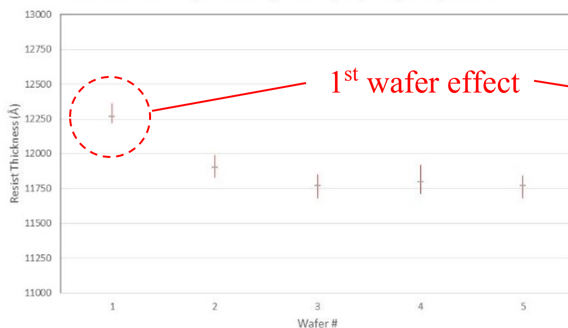


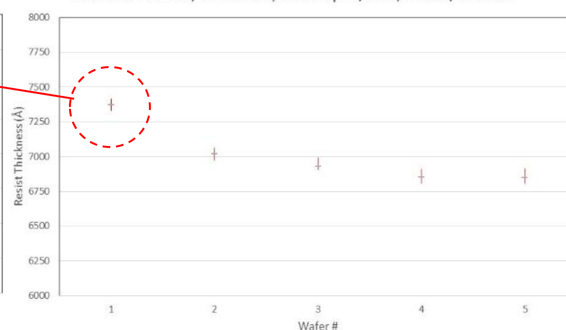
5.2. Install a catch tray for excess resist spin-off.

5.2.1. There are two different catch trays.



One with a lip on the inside opening and one without. The tray with the lip will catch and hold the resist directly under the spin chuck creating a very solvent rich atmosphere as more wafers are spin coated. This high solvent vapor environment may or may not help with your coat process. It is up to the user to experiment and decide which to use. There is a fairly significant effect on the wafer-to-wafer repeatability and within-wafer uniformity by adjusting the amount of solvent vapors are present during spin coating. The amount of solvent vapors can be affected by the amount of residual resist in the catch tray and the amount of exhaust used during the spin coat process. For instance; there is a “1st wafer effect” that occurs when coating samples when the catch tray is clean and dry.



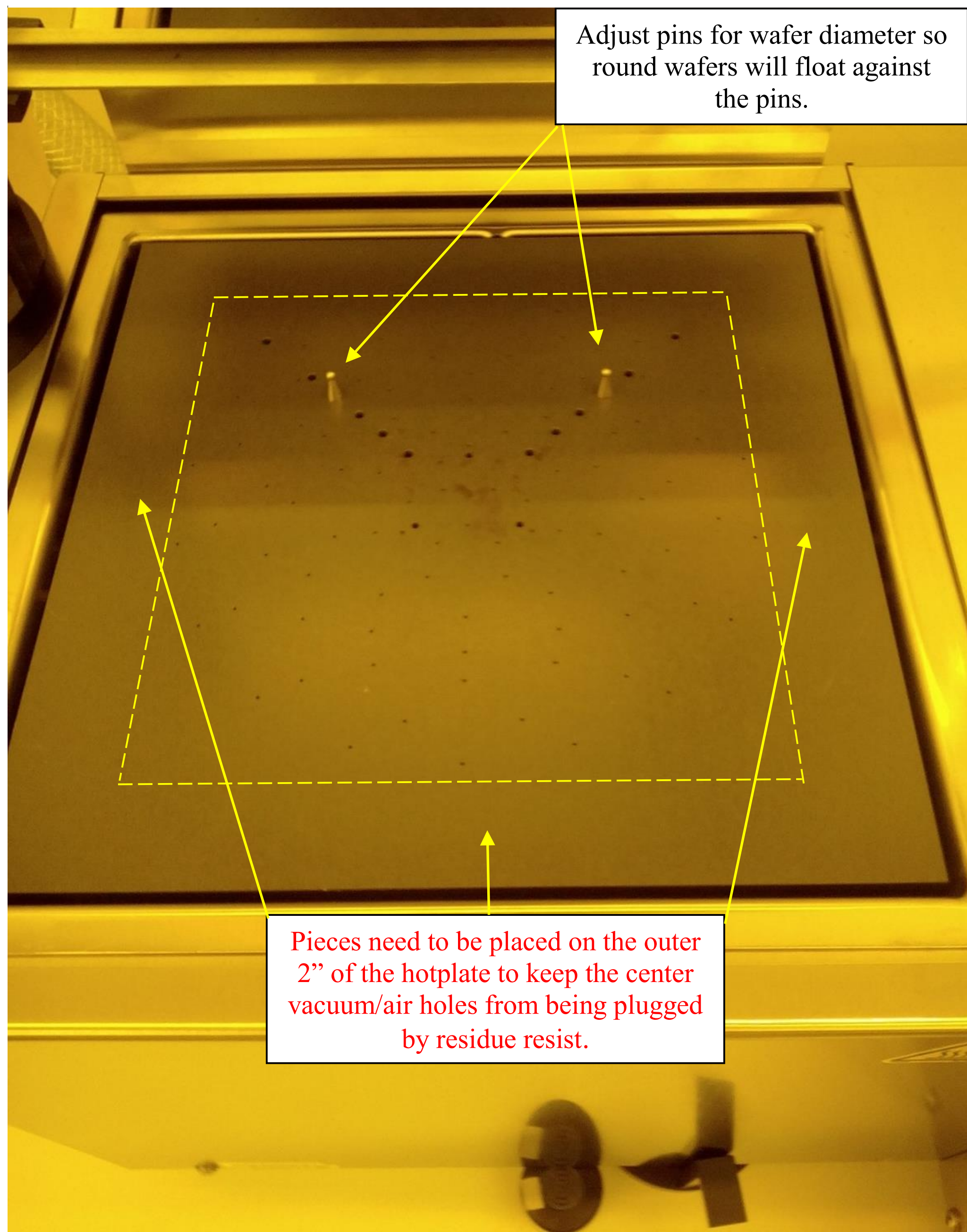


Once the 1st wafer is coated, the excess resist/solvent in the tray will cause the subsequent

films to be thinner because of the higher solvent vapor concentration. For this reason, it is good to run a dummy wafer first, then run the device samples. For coating pieces, it may not be necessary to run a dummy wafer since the amounts of resist in the catch tray are minimal. Once again, it is up to the user to define the process conditions for their coating requirements.

5.3. Adjust the pins on the hotplate for your samples size.

5.3.1. If the samples are pieces, they will have to be placed on the hotplate in the outer 2” of the surface. This is to keep the excess resist associated with pieces samples away from the center of the plate where whole wafers are to be placed



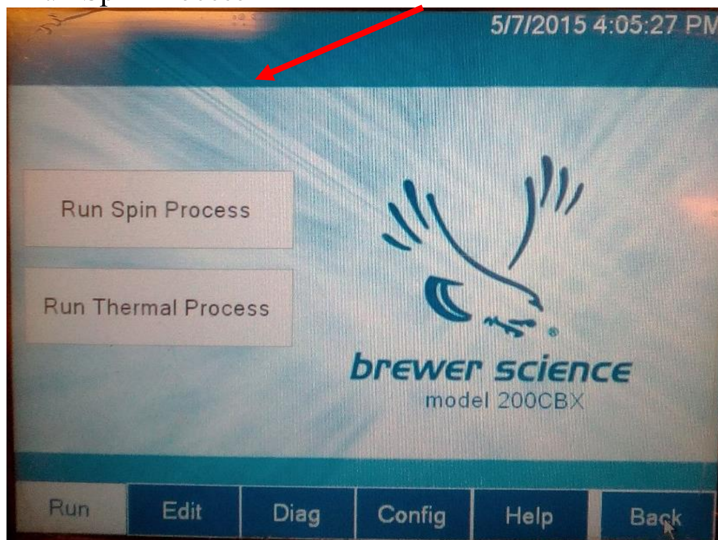
5.4. NOTE: Remember that the system is a serial system. You can only perform one recipe at a time; i.e the recipe for spin coating must reach completion prior to entering the thermal recipe and starting it to run a hotplate recipe. However, if the hotplate is at the proper temperature for your process and you are running pieces without the proximity or vacuum bake feature, you can just place your sample on the hotplate and use a standard timer to time the bake instead of using the system recipe

5.5. If the recipe required has already been written, continue on to step "6. Operating Procedures"

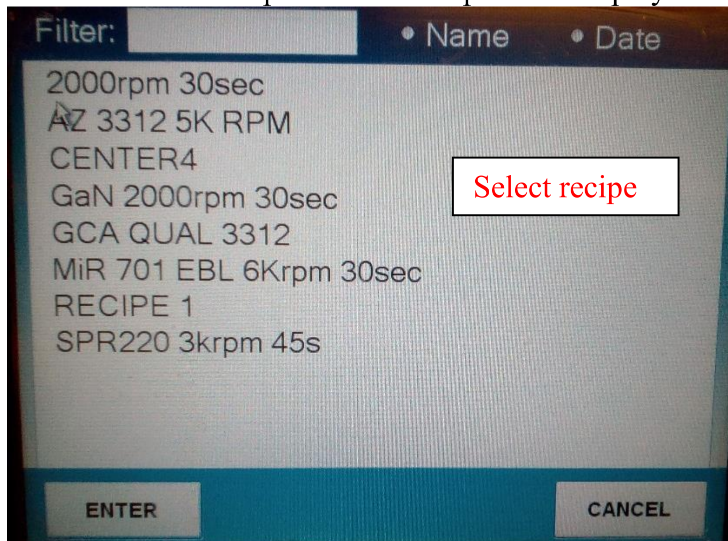
5.5.1. Creating a recipe

5.5.1.1. Spinner Recipe programming

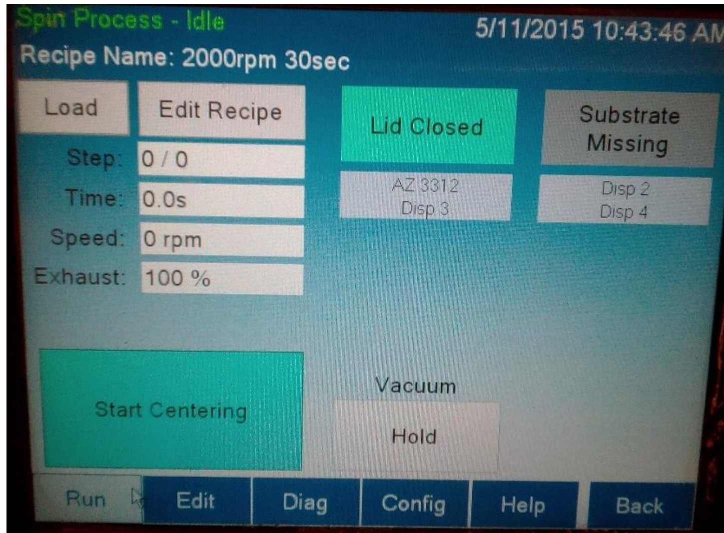
5.5.1.1.1. At the windows desktop, double tap the "Cee" icon. Once the Brewer Sciences splash screen comes up, "Log in" to the system and the main menu will come up. A password screen will come up for you to enter the password. Select "Run Spin Process"



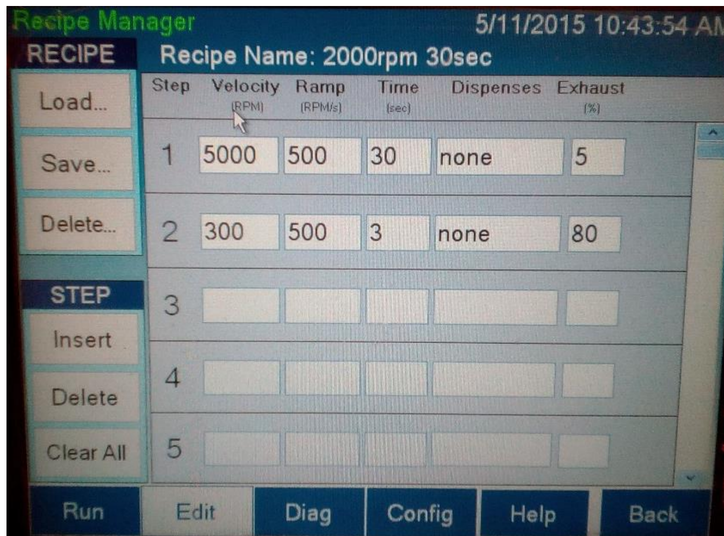
5.5.1.1.2. A list of recipes will show up on the display. Select a recipe



5.5.1.1.3. Hit “Edit Recipe”

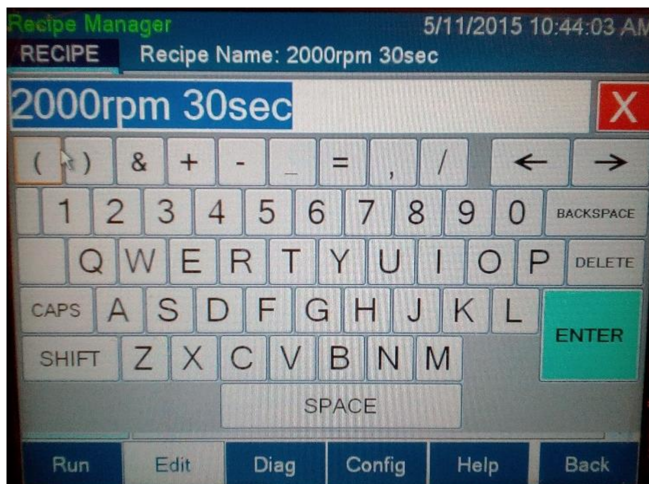


5.5.1.1.4. Edit the recipe that is currently loaded in Recipe Manager

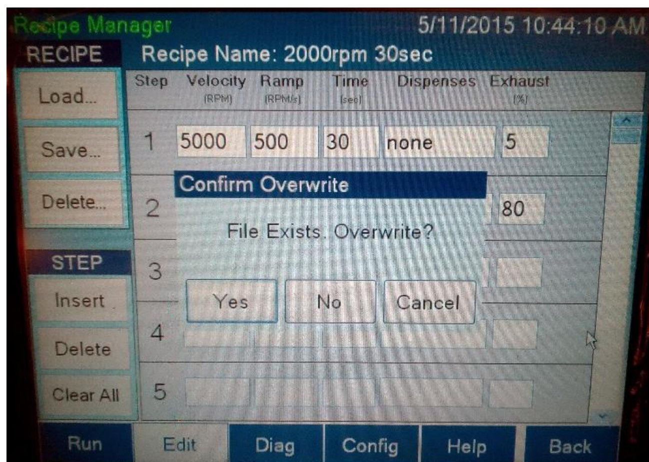


5.5.1.1.5. Change the parameters in the recipe and then hit “Save…”

5.5.1.1.6. Enter a name for the recipe (make sure the name is somewhat recognizable as to the group/person that entered it along with the main parameters, i.e. “AZ3312_3krpm_30s_Staff”)



If you are changing an existing recipe, when you hit “Save..” and the naming window is displayed, just hit “enter” and then hit “Yes” to overwrite the old recipe



5.5.1.1.7. Hit “Run” at the bottom of the screen and you will be back to the Main Menu re-select “Run Spin Process”. You will be taken to the processing window to run your process

5.5.1.2. Hotplate recipe programming

5.5.1.2.1. Log in and ensure you are at the main menu and select “Run Thermal Process”

5.5.1.2.2. Follow the same general sequence as for the Spin Recipes in steps 5.4.1.1

6. Operation Procedures

6.1. Spin coat wafer

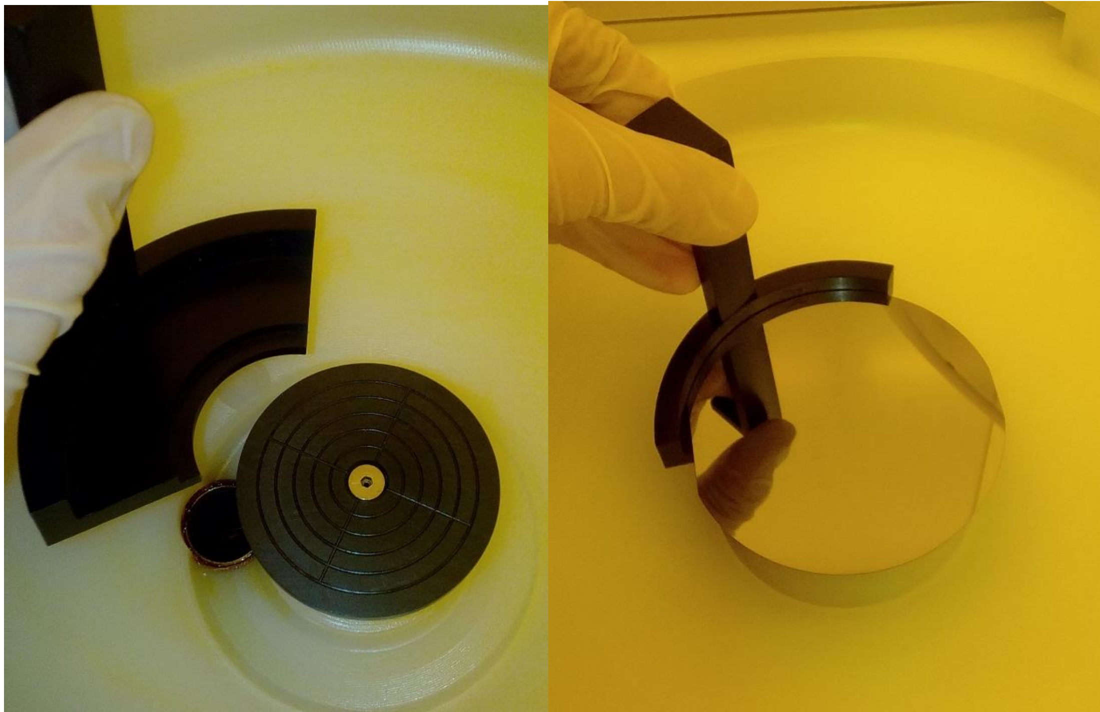
6.1.1. If not already done so, double tap the "Cee" icon on the desktop and/or log in to get to the Main Menu

6.1.2. If running the hotplate using a recipe, select "Run Thermal Process" and select the appropriate recipe to preload the temperature. NOTE: Make sure the hotplate is up to the correct temperature before spinning any samples. Once the hotplate temperature has been reached, continue to the next step

6.1.3. Select "Run Spin Process". The list of recipes will appear on the display

6.1.4. Select a recipe

6.1.5. Place substrate on the chuck; if it a round wafer, use the centering device before hitting the Vacuum "Hold" button



If it is a piece, the substrate will have to be manually centered before pressing the Vacuum "Hold" button

6.1.6. Press the "Center" button on the screen to observe if the sample is centered

6.1.7. Once the wafer stops the slow speed spin for centering, dispense the photoresist on the sample

6.1.7.1. DO NOT put an excessive amount of resist on the sample. Try to keep the photoresist from flowing off the sample around the edges or onto the chuck while statically dispensing. It can get sucked into the vacuum ports which could damage the tool and cause downtime

6.1.8. Close the lid and press "Start Process" button. The wafer will go through the spin process

6.1.9. Once the sample is completely stopped, hit the "OK" button

6.1.10. If coating pieces and using a manual timer instead of a recipe, place piece sample on hotplate and start timer. Then skip to step 6.1.12
6.1.11. If running the hotplate recipe, hit the “Back” button to get to the main screen.
6.1.12. Select the “Run Thermal Process” button
6.1.13. Hit the “Run Process” button for the thermal recipe and transfer the sample from the spin chuck to the hot plate
6.1.14. Once the bake process is complete, hit “OK” button and either continue to spin coat your next sample or proceed to clean the residual resist from the spin bowl (Step 6.2)

6.2. Clean the spin coat bowl
6.2.1. Take off chuck from spindle. Clean it if necessary
6.2.2. Remove the inner bowl liner and clean with acetone
6.2.3. Clean the resist collection trough at the bottom of the spin bowl
6.2.4. Clean the rim on the lid. Acetone is OK to use for this
6.2.5. Clean the clear plexiglass. NOTE: DO NOT USE ACETONE. Only use IPA to clean the plexiglass. Acetone will cloud the clear lid

6.3. Clean the hot plate, if necessary.
6.4. When you are finished, press the “logout” button as many times as necessary to get to the Windows desktop screen.

7. Process Data

NOTE: Adhesion Promoter HMDS:

In order for resist to coat well and adhere to the substrate samples, the surface should be hydrophobic. HMDS only works well on surfaces that have oxides or OH-groups. On other surfaces without the oxygen present for HMDS, it is better to just perform a dehydration bake at 120ºC for 60 sec. on a hotplate. On water-free surfaces, HMDS chemically bonds with its Si atom to the oxygen of oxidized surfaces, accompanied by the release of ammonia (NH_3). This causes the OH-groups, which form hydrophilic surfaces with inferior resist adhesion, to be cracked. The methyl groups of the HMDS form a hydrophobic surface thus improving resist wetting and adhesion. The correct application of HMDS is very important in order not to further deteriorate the resist adhesion. In a bubbler or vapor prime oven, water-free nitrogen saturates at room temperature with HMDS vapor. The N_2 + HMDS streams onto the heated (115-125°C), water-free substrate hereby forming a monolayer of chemically bond $Si(CH_3)_3$ groups responsible for the desired hydrophobic characteristics. In the case of spin-coating of HMDS, a too thick HMDS film forms on the surface. After resist coating during the softbake, this excess of HMDS releases ammonia which diffuses into the resist and crosslinks the resin near the substrate. As a consequence, development sometimes becomes impossible at the resist/substrate interface. If you do spin coat the HMDS on your substrate as an adhesion promoter, bake the sample for 60 seconds at 120ºC BEFORE coating the resist.

8. Revision History

Effective Date	Originator	DESCRIPTION OF REVISION	Issue
5/11/09	Kevin N.	Initial Release	A
	Kevin N.	Updated 5.5.1.1.1, 6.1.1, and 6.4 for starting the program. Added section 6.4, Section 7 included HMDS discussion.	B
			C
			D
			E
			F
			G
			H