



Chapter 4.26

Headway Manual Load Photoresist Spinner at msink3***(headway1)******(382)*****1.0 Equipment Purpose**

- 1.1 The Headway Photoresist Spinner (headway1) is designed for the manual application of photoresist and spin-on products. There are few simple spin coat programs available on this tool, and a few are open to users' modification based on their specific need. This tool accommodates miscellaneous substrates and wafers using an assortment of chucks available at the station. This spin coater is built into msink3, located in the 382 Bay of the Marvell Nanofabrication Laboratory. See Figure 1 for more detail.
- 1.2 This manual covers the operation procedure of the Headway Photoresist Spin coater available msink3, as well as guidelines for simple modification of the existing spin coat programs on this tool.

2.0 Material Controls & Compatibility

- 2.1 Photoresist and spin-on products.

3.0 Training Procedure & Applicable Documents

- 3.1 Exam Tool
 - 3.1.1 This tool requires an online exam before qualification
 - 3.1.2 Note that you must be qualified on msink3 first in order to be qualified on headway1,2.
 - 3.1.3 Get trained by any qualified member.
 - 3.1.4 Take the online test in Mercury.
 - 3.1.5 Arrange a qualification session with a superuser to show competency on the tool.
- 3.2 [New and old recipe details](#)
- 3.3 [Chapter 1.7](#) - Material & Process Compatibility
- 3.4 [Chapter 2.3](#) - msink3 (Manual Spin Coat & Develop Sink)

4.0 Definitions & Process Terminology

- 4.1 **Exhaust Alarm:** This alarm shuts off the power to the sink, when sink exhaust level falls below a certain limit (currently set at 0.8 inches of water, full scale is 1).
- 4.2 **Fire sprinkler:** There are two fire sprinklers mounted in the head case designed to activate at 286 °F.
- 4.3 **DI: de-ionized (DI)** water used for clean processes with resistivity of ~18 MOhm-cm.
- 4.4 **Polyimide:** a spin-on organic insulator which is typically used as an interlayer dielectric.
- 4.5 **HMDs:** Hexamethyldisilazane is widely used in the semiconductor industry to improve photoresist adhesion to oxide by reacting with the substrate surface in a process known as silylation, forming a strong bond to the surface.

5.0 Safety

- 5.1 Follow general safety guidelines in the Marvell lab, as described by chemical Hygiene and safety rules outlined in Nanolab Chapter 1.1. Make sure the spinner lid is closed and the wafer is secure

on the spin chuck (vacuumed down tightly), before attempting to run the spinner. Do not touch any moving parts.

- 5.2 Put on safety gear: Apron, face shield, and chemical resistant gloves.
- 5.3 Put up the safety shield while the spindle is spinning. This helps with safety and proper ventilation.
- 5.4 EPO red button: Cuts power to the sink in emergencies. Report promptly on FAULTS.
- 5.5 The de-ionized (DI) water deck hose for the sinks is ALWAYS available for emergencies; it provides a good safety backup in the event of exposure to chemicals.
- 5.6 Headway1,2 users must be qualified on msink3 to use the headways. Users must also be qualified on any sink they use for developing their samples.

6.0 Process Data

- 6.1 This tool is not regularly monitored by staff. Refer to the program chart for resist thickness.

7.0 Available Processes, Gases, Process Notes

- 7.1 Manual coating of a variety of photoresists, Polyimide, Spin on glass and other material on different size substrates can be accomplished on this tool.
- 7.2 NanoLab supplied resists are available for purchase from the office in 25 mL volumes. If you need larger volumes, please make a request to process staff. For members with special use photoresists, please contact staff for approval and a “special chemical label”. These photoresists will likely be stored in 381-C3.
- 7.3 The following table lists available standard recipes. **Programs 1-5 are fixed and members are not allowed to modify them. Programs 6-9 are available for users to edit/change.** Details of available spin recipes are available in the appendix section of this manual. These steps can be used as guidelines for editing/setting up new recipes. Always include a ramp up and a ramp down sub-step for each step in your recipe/s.

Recipe Name	Spin Speed	Coated Thickness (um)				
		MiR 701	MiR 900	AZ P4620	LOR 5A	PMMA A2
Recipe 1	1000	1.9	4.6	15.6	1.00	0.095
Recipe 2	2000	1.3	3.1	11.4	0.82	0.075
Recipe 3	3500	1.0	2.3	8.9	0.70	0.062
Recipe 4	4000	0.9	2.1	8.3	0.68	0.060
Recipe 5	5000	0.8	1.9	7.5	0.64	0.055

8.0 Equipment Operation

- 8.1 Enable the system on Mercury and check for any problem reports.

8.2 **Spinner/Chuck Cleaning and Maintenance**

- 8.2.1 The Headway Photoresist Spinner is designed for the manual application of photoresist and spin-on products. It can accommodate miscellaneous substrates and wafers using an assortment of chucks. It permits accurate control of spin-speed and spin time during the spin coat operation. Make sure your substrate and wafer are larger than the chuck surface so they cover the O-ring on the spin chuck to prevent photoresist or liquid from sucking into the motor shaft while spinning. This document provides information about

the operation of this Headway spinner, as well as handling and disposal of chemicals used in this equipment.

8.2.2 Visually inspect the desired chuck for any resist build up. This must be cleaned before any run. Failure to do proper cleaning may result in vacuum failure.

8.2.3 ALWAYS clean up any photoresist! The bowl on the spinner should be thoroughly cleaned before and after applying photoresist, if necessary. Line the catch cup with fresh aluminum foil for an easier cleanup. Xylene can be used to remove negative resists, while acetone is used for positive resists.

8.2.3.1 Make sure to clean any chuck after using. Do not leave chucks with resist on them.

8.2.4 Always dispose of photoresist-coated foil and towels in the waste container with a fume exhaust collar by the sink. Do not dispose of photoresist residues in an unexhausted waste container.

8.3 Spinner Operation

8.3.1 Lower the spinner cover when not in use. Remove the chuck after each use (and clean, if necessary). Never pour photoresist residue into the sink; always use an organic waste bottle.

8.3.2 Lift the cover by first pressing the black button. If necessary, remove any dirty foil left in the bowl. Use solvent to remove any residual resist on the bowl itself. Line the bowl with a clean sheet of foil.

8.3.3 Recipes cannot be saved or protected in the control module; make sure to only edit an available recipe (6-9). Recipes 1-5 are not to be modified and are fixed for general use. Recipes cannot be run while in programming or review modes. See 8.4 for reviewing a recipe. To exit from reviewing mode, simply press STEP and then 0 on the keypad.

8.3.4 Place the desired chuck in the spinner. There are several chucks located on the peg board next to the tool. Make sure that the chuck is firmly seated on the spindle.

8.3.4.1 The correct layout for the chucks can be found in **Figure 3**.

8.3.5 Place a wafer on the chuck and press VACUUM on the control module to secure the wafer. Display will show VACUUM ON. To turn on/off the vacuum, press VACUUM again. Lower the cover if the sample is ready to run.

8.3.6 The spinner does not start if the vacuum level does not reach the setpoint. If the sample slips off the chuck during operation, the chuck will stop instantly. There is a chance of the sample slipping off on higher speeds if it is not centered properly. Make sure to center the sample on the chuck.

8.3.7 Double check that the lid is secured and the sample is centered on the chuck. The control unit has to be in READY (standby) mode, before starting a spin coat program. To exit reviewing or programming mode, press STEP followed by 0.

8.3.8 Select your desired recipe by pressing RECIPE followed by entering the recipe number.

8.3.9 Press the footswitch on the green side to start the spinner. The foot switch is located by the front left side of the sink (see Figure 1). Pressing on the red side anytime during operation will stop spinning, and an alarm message will display. To clear the alarm and return to standby mode, press the green side again.

8.3.10 The current recipe and step number, spinning speed and step duration will be displayed while running a recipe. It is a good practice to double check steps, while running a spin coat program.

- 8.3.11 Once the coater recipe starts, it will give you ample time to manually dispense photoresist on your wafer. The amount of resist you will need to apply depends on the wafer shape, final spin speed, resist type, etc. A good rule of thumb would be 1/3 of the sample surface initially covered by resist before spreading it over the rest of the wafer/sample. Photoresist is applied by pouring it slowly onto the sample using an eyedropper or syringe. Note: We recommend pre-cleaning these items with an IPA rinse. The glass portion of the eyedropper can detach and then reattach to assist in the rinse.
- 8.3.12 The spinner will spin for a set time/steps, then stop. To disable the vacuum function, lift the cover and remove your wafer for the next process step such as soft bake.
- 8.3.13 **Remove the chuck, discard the foil and clean the bowl if necessary. There should be no resist residue in the bowl when you are finished. Reline the bowl with fresh aluminum foil making sure not to obstruct the exhaust port around the spindle.**
- 8.3.14 **Make sure the vacuum state is set to AU for AUTO (off) before disabling the tool.**
- 8.3.15 If you need a special chuck, please contact Process Engineer 1.

8.4 Verify and/or Editing a Recipe Content

- 8.4.1 Recipes are not protected, therefore user modifiable. Recipes 1-5 are fixed, 6-9 are available for members to change.
- 8.4.2 Each recipe can have up to 9 steps. When reading the contents of a fixed recipe, check that nothing was changed by mistake. This includes sub-steps as well.
- 8.4.3 To select and open a recipe, press RECIPE followed by the number of the recipe. The control panel will turn to REVIEW mode.
- 8.4.4 You can review and edit each step in the recipe by pressing STEP Key (top right corner on the keypad), followed by the desired step number. To return to READY (standby) mode, press STEP and 0.
- 8.4.5 Once in a step, the step duration will be displayed by default at the top of the panel. To change the duration of a step (step time), press STEP TERMINATE then enter the desired value on the keypad and press enter.
- 8.4.6 To see the spin speed of a selected step, press SPEED/RAMP button and the speed will show up in RPM (revolutions per minute) units. To change the speed, punch in your desired value, then press enter.
- 8.4.7 You will need to also check the ramp up/down at a step. You can edit the ramp step by pressing the SPEED/RAMP button twice, or once if you just finished editing the speed value. Input your desired ramp in RPM per second (RPM/SEC) and press enter.
- 8.4.8 To end the recipe in a given step (defining the last step in the spin coat program), change the duration of each subsequent step to 0. By making the time 0 it will ensure the step is not run. It is recommended that your last step drops the speed to 0.
- 8.4.9 Press STEP and then 0 to return to standby mode when you are done with editing or reviewing a recipe. Recipes cannot start in the programming mode. The display should say READY and the number of the recipe selected.

8.5 Display Information & Keypad Layout

- 8.5.1 The first line of the display always shows the recipe and the current mode (READY or PROGRAMMING). The second line shows the selected step, or information on the current step if a recipe is running (time and speed). The third line shows the vacuum status (AUTO or ON), and the last line of the display has maintenance status information only and is covered.

8.5.2 Keypad buttons explained:

- 8.5.2.1 **RECIPE:** pressing this button will turn to programming/review mode anytime. Enter the number of a recipe and press enter to select.
- 8.5.2.2 **STEP:** allows selection of a step in programming mode. To select a specific step, enter the number and press enter.
- 8.5.2.3 **SPEED/RAMP:** in programming mode, press to toggle the display between showing the spinning speed or the ramping of the current step. To modify the value shown, key in the target numbers and press enter.
- 8.5.2.4 **FUNCTIONS:** Not used by members.
- 8.5.2.5 **EXHAUST:** Not used by members.
- 8.5.2.6 **STEP TERMINATE:** Use to define the duration of a step.
- 8.5.2.7 **VACUUM:** press to turn vacuum on or off in standby mode.
- 8.5.2.8 **SYSTEM PARAMETERS:** not used by members.

9.0 Troubleshooting Guidelines

9.1 Vacuum doesn't turn on.

- 9.1.1 Verify that the tool is enabled. Enter standby mode by pressing STEP followed by 0. See status of vacuum on display. Check the chuck to see if it has a firm connection. Press VACUUM to turn on/off. If the problem persists, report on FAULTS.

9.2 Control panel doesn't respond.

- 9.2.1 Check what the display shows. Turn power off and on to the unit with the power switch located in the bottom left corner of the panel. If the problem persists, report on FAULTS including what was on the display.

9.3 Spinning aborted.

- 9.3.1 A recipe stops if the vacuum gets above the set point or the red pedal was stepped on. To clear the display, step on the green pedal once. The display should turn back to READY mode.

9.4 Particles on photoresist coating.

- 9.4.1 Most likely the photoresist in your dropper bottle has been contaminated. Clean a new one and try again.

9.5 Tool gives "Vacuum Error"

- 9.5.1 The main reason for vacuum error is resist build up. After many uses, there tends to be a build up of resist on the chuck. This must be cleaned in order to achieve good vacuum.

10.0 Study Guide

- 10.1 Do you need to put on safety gear when operate Headway1?
- 10.2 How do you choose the correct size of vacuum chuck according to your sample size?
- 10.3 Are you allowed to change program parameters?
- 10.4 When do you need to change aluminum foil?
- 10.5 What do you do if you have a lot of photoresist in the aluminum foil?
- 10.6 What do you do after you transfer photoresist into your dropper bottle?

11.0 Appendices, Figures & Schematics

Standard Recipe Details

Recipe Name	Step	Speed (rpm)	Ramp (rpm/s)	Time (s)
Recipe 1	1	0	500	30
	2	500	500	10
	3	1000	500	60
	4	0	500	0
Recipe 2	1	0	500	30
	2	500	500	10
	3	2000	500	60
	4	0	500	0
Recipe 3	1	0	500	30
	2	500	500	10
	3	3500	500	30
	4	0	500	0
Recipe 4	1	0	500	30
	2	500	500	10
	3	4000	500	30
	4	0	500	0
Recipe 5	1	0	500	30
	2	500	500	10
	3	5000	500	30
	4	0	500	0



Figure 1 - msink3



Figure 2 - HeadwaySpinner Programming Panel



Figure 3 - Headway Chuck Layout