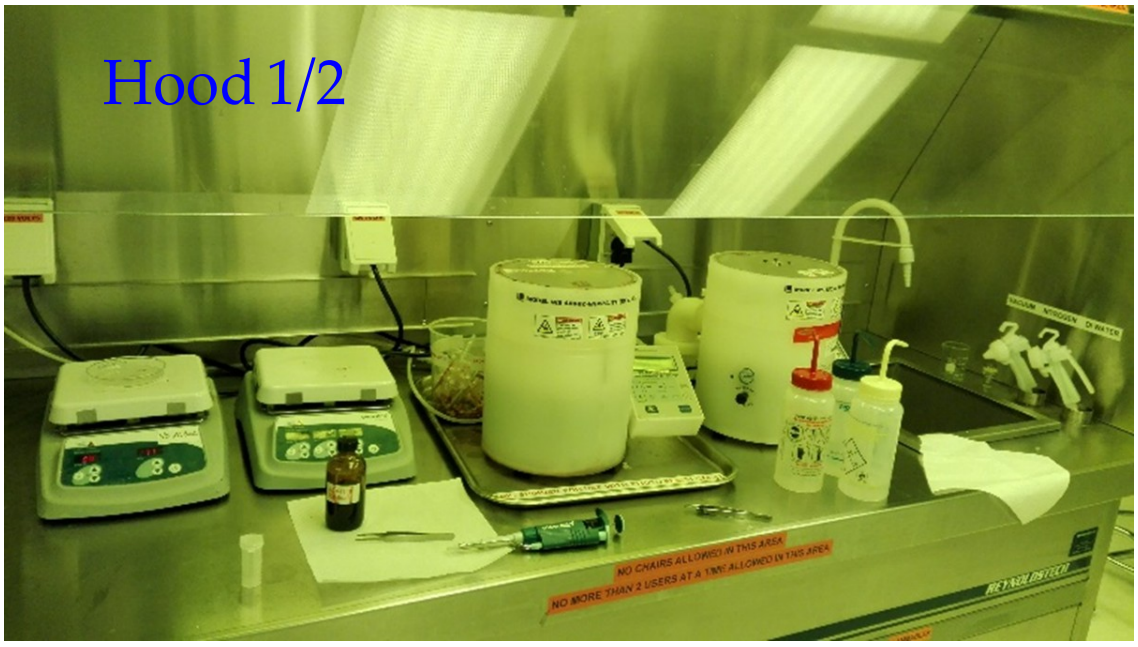
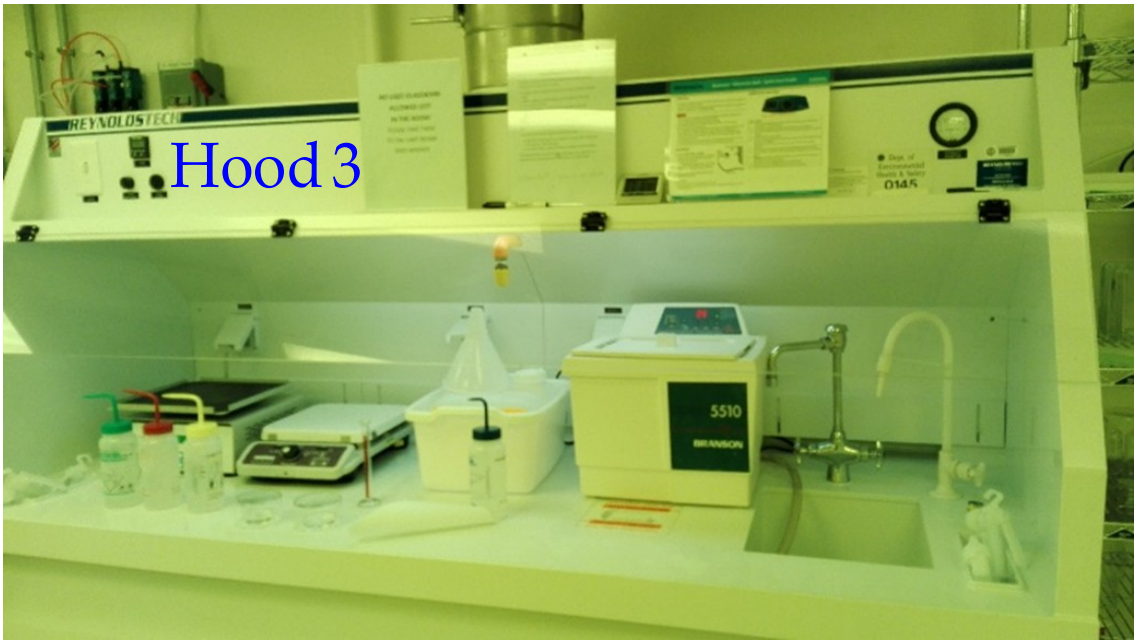
University of Pittsburgh

Nanoscale Fabrication & Characterization Facility

Lithography Hood Users Guide



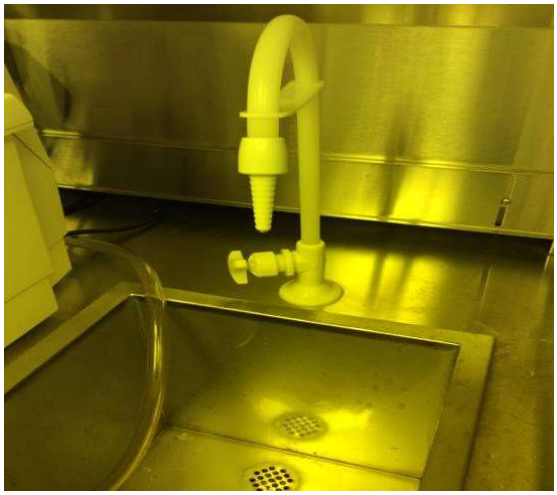


The NFCF Lithography Hood is equipped to provide for a wide variety of both Photo and E-Beam lithography processes.

Hood – Accessories, Equipment & Supplies

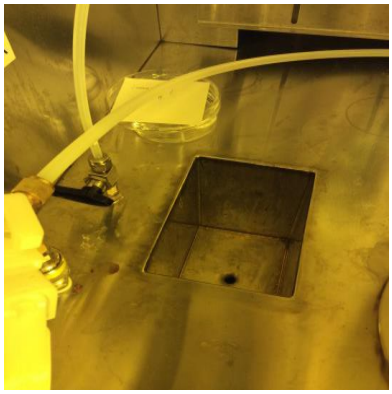
The hood is supplied with the following built-in accessories:

- Sink w/ 18 meg ohm/cm DI Water.



- Spray Guns w/ 18 meg ohm/cm DI Water.
- Blow Guns w/ Nitrogen.

- Power connections.
- Waste bottle for disposal of resist residual.



The work surface of the hood is equipped with the following:

- Laurell WS-400B Spin Processor w/ wafer loading tool & small sample adapters.
- The left spinner for common photo resist, the right spinner ONLY for SU8/PDMS, Hyflon, silk solution, etc.

- Barnstead Super-Nuova hotplates.

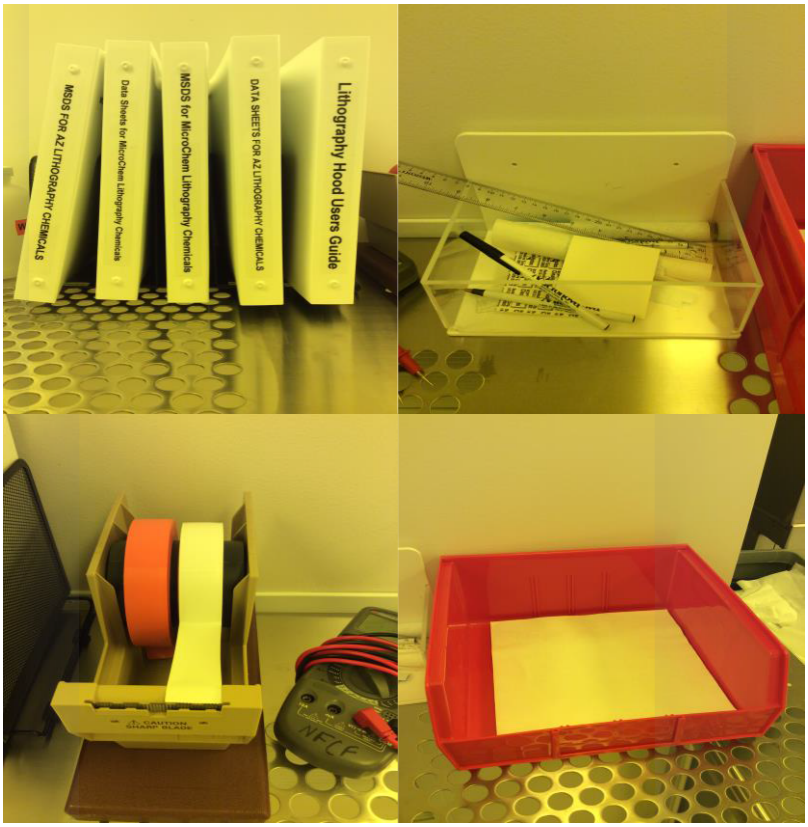
- Branson 5510 Ultrasonic Shaker.

- Squeeze bottles – Acetone, IPA, Methanol & Di Water.

- labware rack: ONLY for clean labware

The following can be found on the adjacent table:

- Operation guides for Ultrasonic tank, hot plates and spinner.
- Wipes.
- Pens & Post-it Notepads.
- 'Lithography Hood Guide Book'.
- MSDS and Date Sheet' notebooks for all Stocked Chemicals.
- Clean room tape for labels.



- Near the chemical storage cabinet:
    - Broken glass & used sharps disposal containers

- On the shelves on opposite wall:
    - PPE Supplies – Gloves, Chemical Aprons and Safety Glasses, Goggles & Face Shield.
    - Glassware, pipets, accessories & supplies.

Available Chemicals:

- Optical and e-Beam Resists & Developers.
- Primers.

- Solvents (Acetone, IPA & Methanol).

- NovaHol & NovaClean cleaners in spray bottles.

- Chemicals are kept in the hood's cabinets below the work surface or in the chemical cabinet to the left of the hood.

- A dishpan & funnel for transfer of used chemicals into the appropriate waste container is kept in both locations.

Lithography Chemicals stocked in NFCF as of 11/3/2017

Optical Lithography:

Resist:	Developer :	Remover :
S1805 (+) Photoresist SC1827 (+) Photoresist Liftoff resist: LOR5B	351, CD26, AZ400K (1:4)	Remover PG
AZ P4110(+) Photoresist AZ P4210 (+) Photoresist AZ P4620(+) Photoresist	AZ 400K (1:4)	1165 remover
AZ 5214-E(-) IR (reversal) Photoresist SU8 (-) 100, 2001, 2002, 2015, 3050	AZ 300 MIF developer SU8 developer	Acetone

E-beam Lithography:

Resist:	Developer :	Remover :
950 PMMA A 2 (+) e-Beam Resist 950 PMMA A 3 (+) e-Beam Resist 950 PMMA A 4 (+) e-Beam Resist 495 PMMA A 4 (+) e-Beam Resist MMA(8.5)MAA EL9.5 Copolymer	MIBK/IPA (1:3)	Remover PG Acetone
ZEP 520A(+) (1:3, 1:5)	ZEP developer	ZEP remover
ma-N2403 (-)	ma-D525	R404S

Primer (adhesion layer)

MCC Primer 80/20 HMDS Primer

Hood Use Procedures

Using FOM, log into the Clean Room and the Lithography Hood.
You will hear the hood power up and power down. The sound is normal.

The hood's 'Hazard Area' is marked on floor with Yellow & Black tape

- Anyone in the "Hazard Area' is required to wear the appropriate Personal Protective Equipment (PPE) as per NFCF policy.
- Eye protection – Safety Glasses, Goggles or Face Shield – is required at all times when inside the "Hazard Area".
- A Face shield & Chemical Apron is required anytime the hood's shield is open and chemicals are being mixed or transferred.
- Chairs are not allowed in this area.

Only 1 project at a time is allowed in the hood.

- No more than 2 people working on a project at a time.
- Additional users may observe but must remain outside the marked 'Hazard Area'.

Wipe up all spills immediately – no matter how small.

- Clean under equipment when necessary.
- Use NovaHol and/or NovaClean cleaner.
- If a mess is found in the hood before you start, it should be reported to the NFCF Staff.
- Dirty equipment or other messes left after use will result in loss of access.

Keep hands dry

- Change gloves as often as necessary. Wearing two pair of gloves is advised.

Notify NFCF Staff of any chemicals containers that are low or empty

- Place clean (outside), sealed, empty chemical containers in Pass-through and notify NFCF Staff

Notify NFCF Staff of any waste chemical containers that are approaching full.

Notify NFCF Staff of any supplies that are getting low.

Do not put timers or other items that are not compatible with solvents on the hood's work surface

- Timers may be placed on ledge above hood's shield.
- NOTE: No other items should be placed on this ledge.

Do not clean the hood shield with solvents or abrasive materials.

Clean, dry and return all accessories & equipment used to the proper storage location.

Turn off and properly clean all equipment & the hood's work surface when finished

- Spin Processor: Power 'OFF', N2 purge 'OFF', Bowl – 'Clean'!!
- Hot Plates: 'OFF'
- Ultrasonic Bath: 'OFF'
- Water: 'OFF'

Chemical Use Guidelines

MSDS sheets are provided for all stocked chemicals.

- Before use of any chemical users must review and understand the appropriate MSDS sheet. The MSDS for each chemical is located on the table adjacent to the lithography hood.

Technical Data sheets are available for the Lithography chemicals

- For best results it is advisable to review these data sheets before beginning use of any chemical. They are also located on the adjacent table.

All chemical use must be done in the hood.

- Only chemical work is allowed in hood.
- Support materials, notebooks, etc. are not permitted in the hood, use the adjacent table.

NOTE: *The mask aligner & microscope tables are **not** to be used for chemical work, support work, supplies, etc. Absolutely no liquids of any kind are to be used on these tables or instruments for any reason!*

Keep chemical containers in hood when not in cabinets.

Keep chemical containers closed when not transferring chemical.

- Clean containers' threaded top before replacing cap.

Do not pour resists!!! Use pipettes when transferring.

Clean & put chemical containers away as quickly as possible when finished transferring chemicals.

Always hook doors to chemical cabinet open when removing or replacing chemicals.

Clean up all spills immediately.

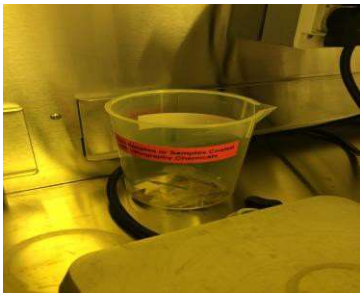
Waste Disposal

- Solvents & Primers
  - Use the hood's waste solvent disposal sink.

- All other chemicals.
  - Each of these chemicals has its own waste container for disposal:
    - Select the appropriate waste container for the chemical & place in dishpan.
    - Remove container's cap & place funnel in container.
    - Pour waste chemical into container & allow funnel to drain completely.
    - Remove funnel, thoroughly clean & dry.
    - Cap waste container, remove from dishpan, clean and return to appropriate cabinet.
    - Make sure dishpan is clean, place funnel in pan and return to appropriate cabinet.

- Used Pipets should be placed in the properly labeled beaker on hood's work surface

- Waste pieces, broken samples or with lithography chemicals should be placed in marked beaker on hood's work surface.



- Used wipes should be disposed of in the adjacent waste container only.

- Broken glass should be placed in the Broken Glass container.

- Used sharps (razor blades, etc.) should be placed in the Waste Sharps container on the chemical cabinet.

Laurell WS-400B-6NPP-Lite Manual Spinner
Users Guide

NOTE:
Your sample should not be wet or have sticky chemicals of any kind on the back side. If it does, water and chemicals can get pulled into the vacuum line. This will eventually destroy the tool and may cause problems for the vacuum system as a whole.

Similarly, you must never spray solvents onto the chuck while it is on the tool; the solvents will be pulled into the vacuum line. This will eventually destroy the tool and may cause problems for the vacuum system as a whole. For this reason, when cleaning the bowl, a dummy sample should always be clamped onto the chuck.

It is a good idea (although not required) to dehydrate your sample prior to spinning on resist.

Material Requirements:

1. Equipment: substrate/sample, photoresist, primer (adhesion promoter - if needed) wafer tweezers, pipettes
2. Personal Protective Equipment: Nitrile gloves, safety glasses, chemical apron

Procedure:

Startup:
1. Open the N_2 valve on the hood deck to the left of the spinner. This is the purge for the spinner.
2. Be sure the vacuum line is connected to the quick connect on the hood deck to the left of the spinner.
3. Turn the spinner 'ON'. The "Vacuum" warning should be flashing. The "CDA" warning should **not** be flashing. If it is flashing, the spinner is not receiving sufficient N_2 for some reason. Make sure the valve is on and the line is connected to the spinner.
4. Make sure the waste cup is connected at the back of the spinner & that it is not full.
5. Turn on the soft-bake hotplate, and make sure it is set to the right temperature.

Programming:

1. Select which program you want to use. Push “program select” to cycle through program A through T. Please DO NOT edit program T, this is the cleaning program. In program A, please edit only the “spin speed”, leave everything else the same. You are free to edit programs B-S as desired.
2. Push “F1” to edit the current program. Edit, add, & delete steps, and edit the step time (in seconds), final spin speed (in rpm) as desired. The “acceleration index”, labeled “ACL” should be set to the default, 015, for all steps. The tool will compute the acceleration rate in rpm/second and display it next to the ACL setting.

A “normal” program might have 5 steps. This would be a 4 second, 500 rpm “spread” followed by a 30 second 3000 rpm “spin”. Program “A” should be set up like this, only the 3000 rpm number in Step 3 and Step 4 should be changed.

Step 1: Time 2 sec, Speed 500 rpm, ACL 015	Ramps up to 500 rpm in 2 sec
Step 2: Time 4 sec, Speed 500 rpm, ACL 015	Holds at 500 rpm for 4 sec
Step 3: Time 2 sec, Speed 3000 rpm, ACL 015	Ramps up to 3000 rpm in 2 sec
Step 4: Time 30 sec, Speed 3000 rpm, ACL 015	Holds at 3000 rpm for 30 sec
Step 5: Time 2 sec, Speed 0 rpm, AC 015	Decelerate to 0 rpm in 2 sec

3. Once you’ve got your program all set, push F1 to go back to operating mode.

Loading a sample:

A. Wafer

1. Set the pins on the wafer alignment tool to your substrate size. Put your wafer on the tool hard up against the stops.
2. Open the lid.
3. Use the tool to center the wafer on the chuck. Push “vacuum” to turn on the vacuum. The wafer should be stuck on the chuck (check it!). The “Vacuum” warning should stop flashing on the front panel.

B. Non-wafer

1. Pick up your sample with your tweezers
2. Open the lid
3. Place sample as centered as possible on the chuck. Push “vacuum” to turn on the vacuum. The wafer should be stuck on the chuck (check it!). The “Vacuum” warning should stop flashing on the front panel.

Static Dispense:

Note: It is strongly recommended that before you trust your program, you put a dummy sample on the tool and run your program without any chemicals to make sure it works as desired!!!!

1. Load primer / adhesion promoter, if used, into a puddle on top of the sample using a pipette. Do not load it so full it flows over the edge. If not used skip to step 5.
2. Close the lid.
3. Run the program. The “primer” will spin off.
4. Open the lid.
5. Load photoresist onto the top of the wafer using a pipette. Do not load it so full it flows over the edge. Do not allow any bubbles in the resist. If you get any, try to suck them up with the pipette.
6. Close the lid.
7. Run the program.

Removing the wafer and soft-bake:

1. Remove the sample with your tweezers.
2. Put the sample on a hotplate to soft bake. (You must determine soft bake times and temperatures from the manufacturer datasheets.

Lithography hoods cleaning rules and procedures

(Hood area is monitored!)

Mandatory: Immediately after every use, the users are required to clean the hoods following the procedures below and leave comments: '*clean/dirty before use, clean/dirty after use'* at the log off page.

- If any portion of the below requirements are lacking, dirty status should be recorded in your logoff comment.
- If you find the spinner in a dirty status, but fail to leave a logoff comment indicating the dirty status, you will become responsible for the dirty status as the most recent user.

Policy for violations

- First violation: Warning issued to user
- Second violation: Second warning issued to user, carbon copy to PI
- Third violation: loss of access to the equipment and/or the lab.

Clean status of the hoods:

Clean status is applicable if all of the following are met:

- Inside and outside of the spinner are both clean.
- No photoresist residual remains anywhere in the hood.
- No samples, wipes, liquid, labwares, tools, timers, pens, etc. are left in the hood.
- Spinner and hotplates powered off, N2 gas valve off

Cleaning procedure

1) Clean backside of your chip before your place it on the hotplate! Otherwise, the residual resist from the backside will make a permanent contamination on the hotplate.

2) Clean the spinner immediately after every use! Do not let it dry!
    - Run ‘program T (or #4)’ for cleaning –following the instruction. Be careful not to get solvents inside the spindle area.
    - Wipe everywhere inside the spinner after the cleaning program is complete!
    - Keep wiping the inside of the spinner, and spray some additional acetone if necessary, until thoroughly clean
3) **If you use LOR-5B, you have to clean the spinner immediately after the coating program done**. Do not wait until you finish the coating of another photoresist. The mixture of LOR-5B and another photoresist will become very sticky and hard to remove by acetone. More importantly, if under any circumstance, LOR-5B is permitted to dry, it will turn into light chips and fly everywhere - which contaminates the whole cleanroom!
4) Empty the photoresist residual immediately after every use! To do so, carefully take out the waste bottle of the spinner, and pour photoresist residual to the designated waste bottles (waste bottles are placed inside the hood with a funnel).
5) Clean all other areas of the hood with wipes. It is not permitted to leave any sample, wipe, tool, or labware in the hood after use.
6) Change your gloves if they get dirty or wet. Do not touch anything inside or outside the hood with dirty or wet gloves!
7) Turn off the power to the spinner and hot plate, and close the N2 gas valve before logging off.

SPINNER CLEANING PROCEDURE

To be completed after every use!

1. When finished with your samples – load a dummy sample onto the chuck and turn Vacuum 'ON'.

2. Using a squirt bottle – spray acetone through hole in chamber's lid onto dummy sample.

3. While continuing to spray acetone through hole in lid – run the "Clean Program" (Program T or #4) –continue spraying for the duration of the program. This should spray acetone over the entire inside of the chamber and wash resist residue into drain.

   Clean Program: (T)
   a) *Step 1: Time 10 sec, Speed 1000 rpm, ACL 015*
   b) *Step 2: Time 10 sec, Speed 3000 rpm, ACL 015*
   c) *Step 3: Time 10 sec, Speed 5000 rpm, ACL 015*

4. If any resist remains – repeat steps 1 – 3.

5. When no resist remains – repeat steps 1 - 3 with IPA.

6. When finished – empty spinner's waste reservoir into photoresist residual waste bottle.

7. Wipe up any excess liquid remaining in lid's groove & chamber bottom using cleanroom wipes and acetone.

8. Dispose of wipes in trash.

Shutting Down:

1. Turn off the spinner.

2. Close the N2 valve on the hood deck to the left of the spinner.

3. Clean up any spills.

4. Put all chemical in their proper location and wipe down surfaces.

Attention to spinner for special chemicals (the right one in Hood 1)

This spinner is only used for special and sticky chemicals. currently available for SU8, PDMS, Hyflon and silk solution.
This spinner share Nitrogen gas and vacuum with the other spinner.
Please clean the spinner thoroughly after everyuse follow the procedures as bleow: