Standard Operating Manual

Buehler EcoMet™300 Copper Polisher

Contents

Buehler EcoMet™300 Copper Polisher

1. Picture and Location

Fig.1 Buehler EcoMet™300 Copper Polishing Machine

This tool is located at Room 2227.

2. Process Capabilities

2.1 Cleanliness Standard

EcoMet™300 Copper polisher is classified as a **Non-Standard** equipment.

2.2 Possible Polishing Materials

Copper, CNT, Silicon, Silicon Oxide, Nitride, etc.

2.3 Process Specification

What EcoMet^{TM}300 Copper Polisher CAN do

1. EcoMet^{TM}300 can provide mechanical polish of sample surface using different size of slurry corresponding to different type of polish cloth.
2. EcoMet^{TM}300 can polish the samples with thickness from tens microns to one millimeters.
3. EcoMet^{TM}300 can polish the samples in any shape, with size smaller than 4 inch.

What the EcoMet^{TM}300 Copper Polisher CANNOT do

1. EcoMet^{TM}300 should not be used to polish a sample larger than 4 inch in diameter.
2. EcoMet^{TM}300 should not be used to polish a sample not bounded on our standard holder.
3. EcoMet^{TM}300 should not be used to polish a sample with large area of metal on the surface.
4. EcoMet^{TM}300 should not be used to polish a sample with any photoresist coated on the surface.
5. EcoMet^{TM}300 should not be used to polish a sample with fine structures on the surface.
6. EcoMet^{TM}300 should not be used to polish a sample using polishing cloth, slurry or lubricant not from NFF.

3. Contact List and How to Become a Qualified User

3.1 Emergency Responses and Communications

1. Security Control Center: 2358-8999 (24hr) & 2358-6565 (24hr)
2. Wing Leong CHUNG - Safety Officer (2358-7211 & 64406238)
3. Preason Man Wai Lee – Deputy Safety Officer (2358-7900),
4. Henry Chun Fai YEUNG – Senior Technician (2358-7896 & 2358-7219)

In case of technical help, please contact NFF staffs,

1. Henry Chun Fai YEUNG – Senior Technician (2358-7896 & 2358-7219))
2. Shuyun ZHAO –Scientific Officer (2358-7212)

3.2 Training to Become a Qualified EcoMet^{TM}300 User

Please follow the procedures below to become a qualified user of the EcoMet^{TM}300:

1. Read all materials provided on the NFF website of the EcoMet^{TM}300.
2. E-mail to Mr. Henry Chun Fai YEUNG requesting EcoMet^{TM}300 operation training.
3. Hands-on operation training for EcoMet^{TM}300 is required.
4. Pass the examination for the equipment operation and the security.

4. Operating Procedures

4.1 System Description

EcoMet^{TM}300 copper polisher is composed of power head, D-shape bowl and control panel. This system is designed to provide mechanical polish of sample

surface using different slurry corresponding to different type of polish cloth. To get a defect-free surface, it normally needs multi-steps from coarse to intermediate and to fine polish.

The sample needs to be bounded on a 4-inch ceramic holder using wax. Then put the ceramic holder and the drive adapter together and fix them using adhesive tape. After fine polishing, the surface roughness can reach the level of ~1nm.

4.2 Safety Warnings

1. If the equipment failure while being used, never try to fix the problem by yourself. Please contact NFF staffs.
2. In emergency, please push the red emergency button to interrupt the equipment power, and report to the NFF staffs immediately. DO NOT attempt to resume the equipment on before the problem is solved.
3. During process, if something going wrong and you are not sure what happens, please report to NFF module staffs.

4.3 Operation Precautions and Rules

1. Please reserve the time slot on your own, and make sure you use your own time slot to do the polish process.
2. Please fill all the details of the logbook attached, i.e. date, name, project number, email, project details, material …
3. Do not operate the equipment unless you are properly trained and approved by NFF staffs.
4. Do not leave an on-going etching process unattended.

5. Do not use the equipment after office hour.

4.4 Initial Status checks

1. Please check the status of shutdown notice posted in the NFF reservation website.
2. Please check the reservation status on the website, and reserve the right time slot by your own.
3. Please check-in the equipment on your own according to the reserved time slot.
4. Before operate the machine, please make sure you have read and checked the details of the check list.

4.5 Initial system checks

1. Turn on the main power on the backside and check the front blue power button in ON.
2. Check the N_2 the pressure is ~35psi.
3. Please check the water level is lower than the mark on the water tank.

4.6 Preparation before Polishing

A) Sample preparation--wafer bonding

1) If the sample is irregular shape, please polish the sharp corner using abrasive paper before wafer bonding.
2) Put the ceramic holder on the hotplate.
3) Turn on the hotplate, as shown in Fig. 2, adjust the knob to position 6-7, wait for 3~5 minute.

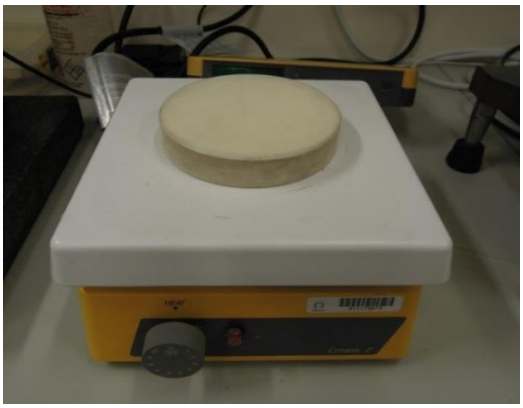


Fig. 2

4) Melting enough wax on the ceramic holder, as shown in Fig. 3.

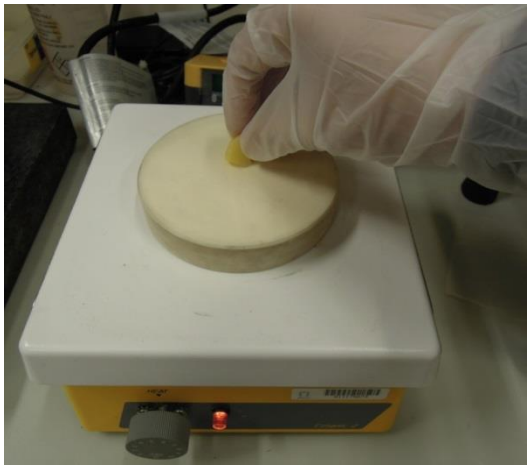


Fig. 3

5) Put your sample on top of the wax, and move the wafer in different direction to even the wax for a flat surface, see Fig. 4.

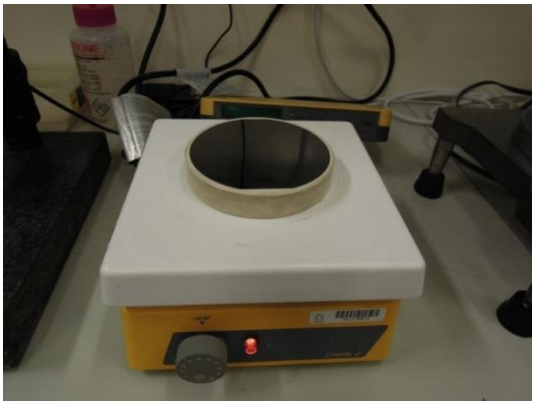
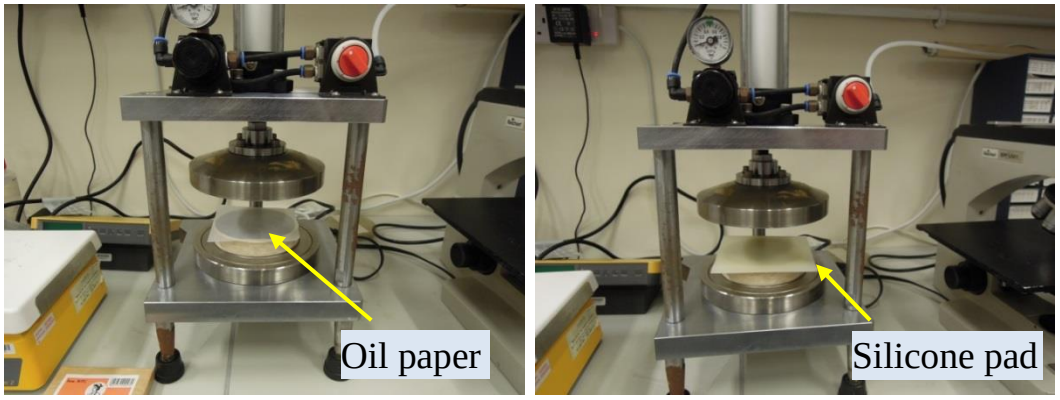


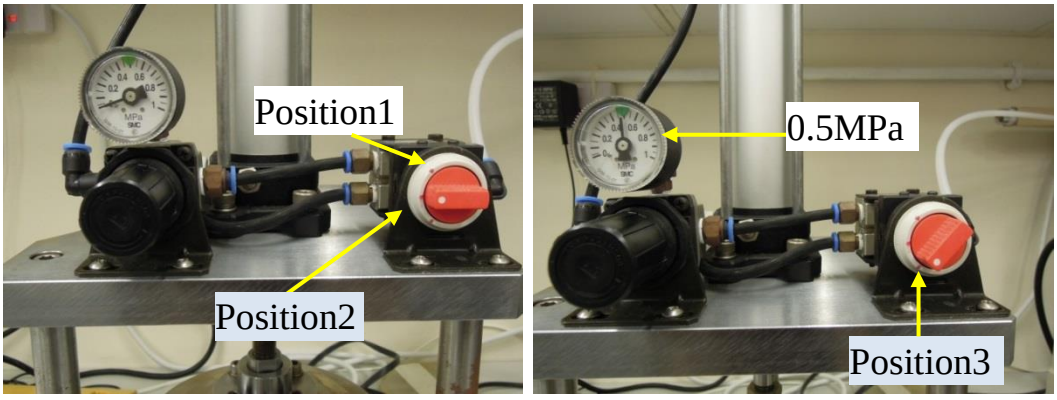
Fig. 4

6) Put on the heat-resist glove to move the ceramic holder onto the bonder, and put an oil-paper (Fig.5a) and a soft silicone pad on the top, as shown in Fig. 5b.



(a) Fig. 5 (b)

7) Switch the RED pneumatic button to horizontal (position 2), as shown in Fig. 6a, and let the heavy metal drop down to the sample surface. Then switch the RED pneumatic button to position 3 to add 0.5MPa pressure to heavy metal for around 5mins until the ceramic holder is cooled down to room temperature (Fig. 6b). DON'T adjust the pressure by yourself.



(a) (b)

Fig. 6

8) Take out the ceramic holder by switching the RED pneumatic button back to position 2 and then position 1. The heavy metal will lift up to initial position. Please be careful about the ceramic holder. Sometimes the ceramic holder will goes up together with the heavy metal. User should put one hand under it immediately, otherwise, the ceramic holder will drop to the bottom and might be broken.

9) Take out the ceramic and measure the thickness or flatness using dial gauge, shown in Fig. 7.

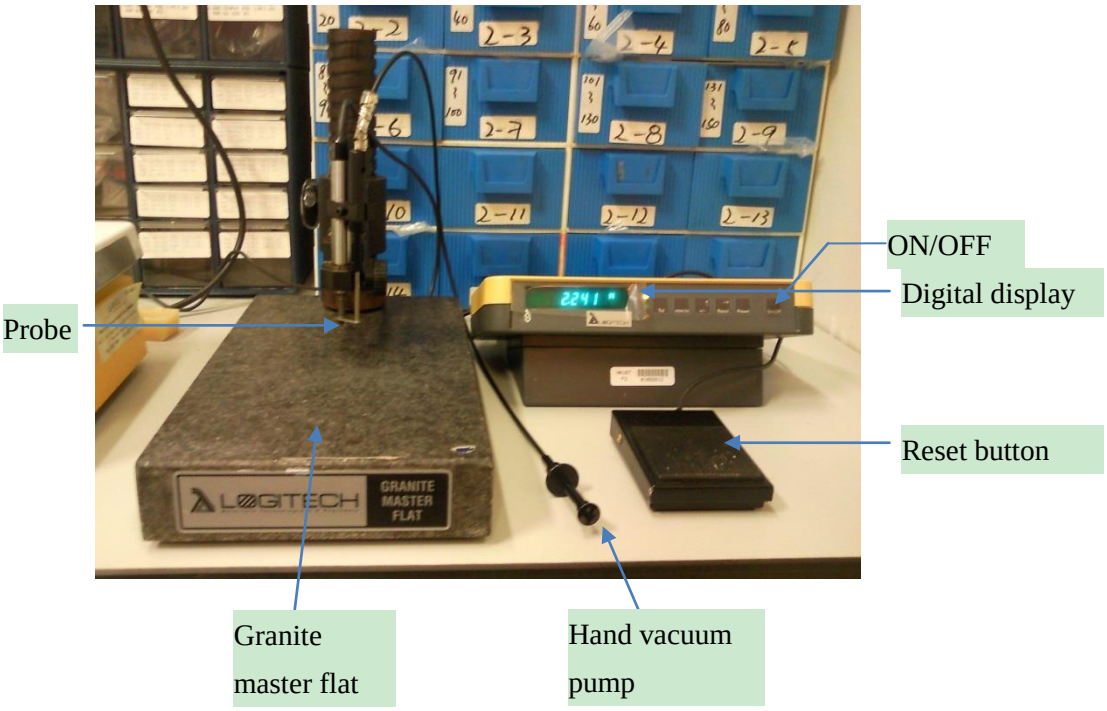


Fig. 7

- Put the sample on top of the granite master flat;
- Press the ON/OFF button to turn on the dial gauge;
- Push the hand vacuum pump to rise up the probe, and release it to let the probe touch sample surface.
- Click the reset button to reset the zero position (optional);
- Push the hand vacuum pump and move the sample, then release it to do the measurement.

B) Drive adapter and ceramic holder bonding

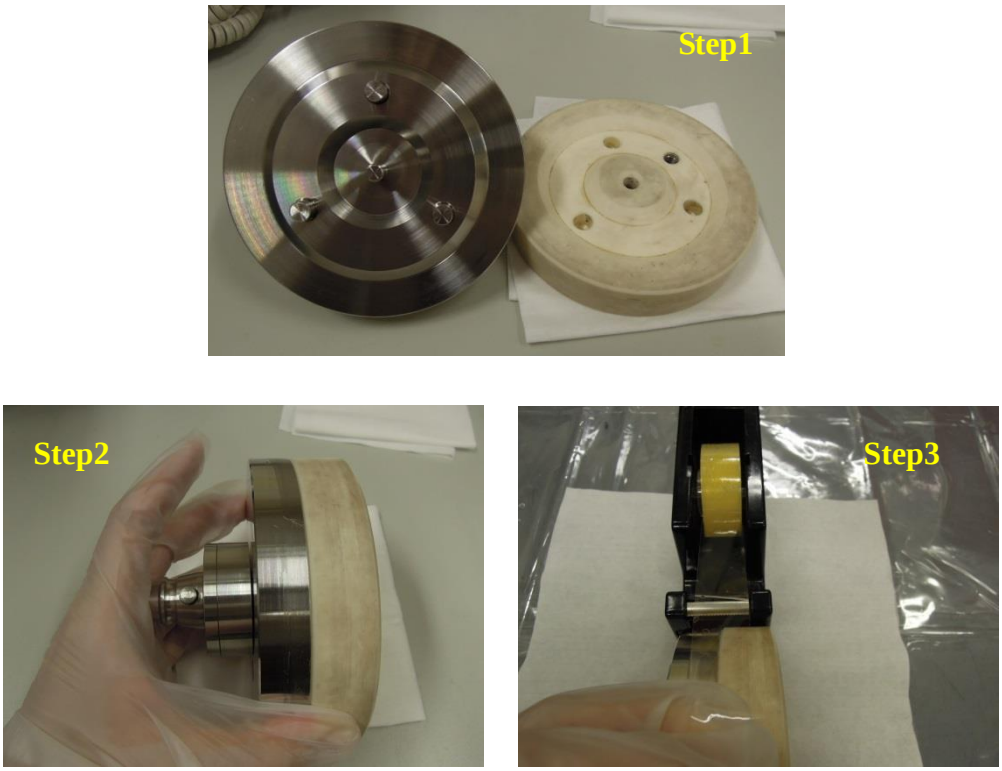


Fig. 8

- As shown in Fig. 8. The sample is bonded on the ceramic holder.
- Put the ceramic holder and the drive adapter together as shown in step 2.

- Use the adhesive tape to fix them together as shown in step 3.

4.7 Polish Cloth and Slurry Selection

Select proper polishing cloth and slurry (diamond suspension) size according to your requirements.

The polishing pad is bonded on a Teflon coated metal plate. Put the polishing pad and metal plate on top of the magnetic disc.

- We will help user to develop your own process using NFF polishing pad at the beginning.
- You have to buy your own polishing pad from NFF for normal user.
- You have to keep your own polishing pad by yourself.
- DON'T use any polishing cloth, slurry or lubricant not from NFF.

Fig. 9 Different size of diamond suspension and Lubricant

4.8 Polish Parameters Setting

Fig. 10 shows the control panel of EcoMet™300 polisher. The detailed functions of the buttons are listed below.

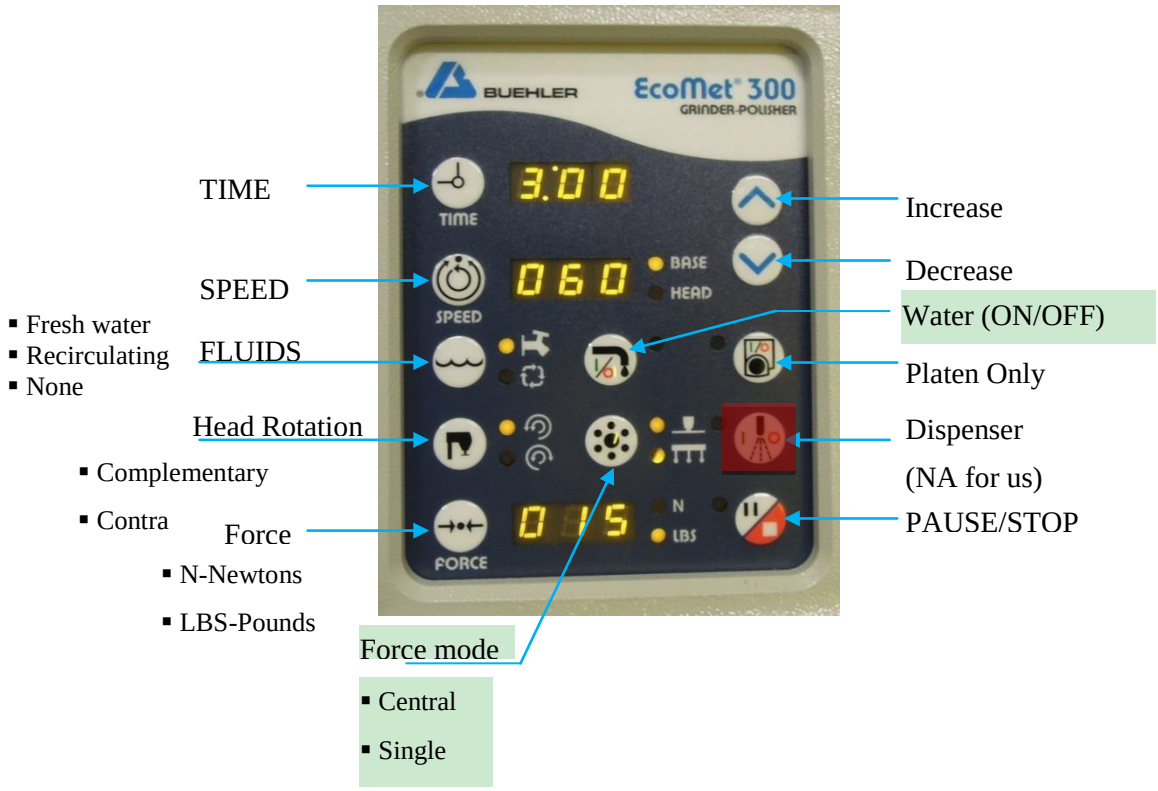


Fig. 10 Control panel of EcoMet™300 polisher

	TIME	……	Displays the time set for a grinding polishing cycle
	SPEED	……	Displays the selected rpms of the platen or power head
	Fluids	……	Selects between fresh water, recirculated water, and OFF
	Head rotation	……	Selects the rotational direction of the head and specimen holder. (Complementary or Contra)
	Force	……	Displays the amount of operational force applied to the specimens in specimen holder.
	Water	……	Activates the water flow for platen cooling and rinsing
	Force mode	……	Selects between Single or Central mode (Central for large sample)
	Increase	……	Increase the parameter value for time, speed, and force.
	Decrease	……	Decrease the parameter value for time, speed, and force.
	Platen only	……	Activates the platen for manual polishing
	Dispense	……	Activates a connected dispenser (No use for us)
	Pause/stop	……	Pauses or stops a cycle

- **Example of polishing procedure:**

Polishing procedure:

Step 1 is for coarse polish, steps 2&3 are for intermediate polish and steps 4-6 are for fine polish.

Steps 5&6 are for final polish. The polishing time here is typical and can be adjusted according to the requirement result. The larger size of slurry, the faster removing rate is. User should select your own process steps and time according to your requirements.

Steps	Slurry		Polishing cloth		Lubricant	Time (min)
	Ingredients/Size	Color	Name	Color		
1	Diamond/15μm	Brown	TexMet™ P	Lt yellow	MetaDi Fluid	3
2	Diamond/6 μm	Yellow	Verdu Tex	Green	MetaDi Fluid	3
3	Diamond/3 μm	Green	Verdu Tex	Green	MetaDi Fluid	3
4	Diamond/1 μm	Blue	Micro Cloth	Gray	MetaDi Fluid	3
5	Silica /0.06 μm	Blue	Micro Cloth	Gray	Water	3
6	NO	NA	Micro Cloth	Gray	Water	3

- Typical parameters:

  TIME=3mins

  SPEED=60rpm for both base and head

  Fluid is set to fresh

  Water is set to OFF

  Head rotation is complementary

  Force=10 LBS

Note: To use water, position the Water Dispensing Arm over the platen. Press the "Water" button. The "Water" LED will light and water will be dispensed from both the Water Dispensing Arm and the Platen Bowl Wash.
Turn the Water Control Knob counter-clockwise to increase the water flow through the Water Dispensing Arm. This will decrease the flow of water through the Platen Bowl Wash. Vice versa is true.

4.9 During the Run

(1) Moving and positioning the power head

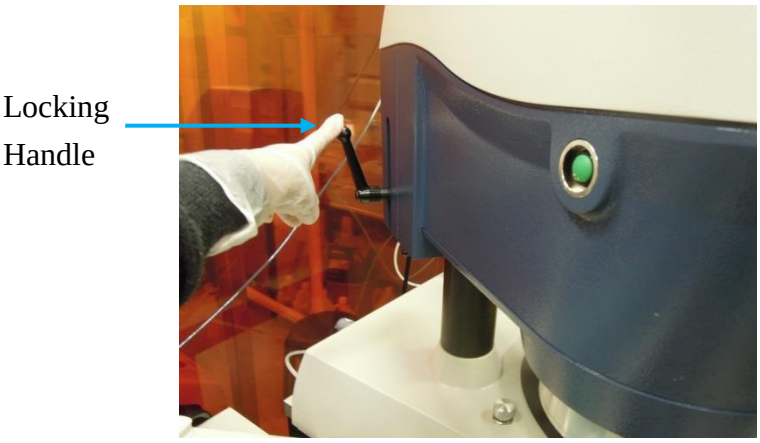


Fig. 11 Locking handle of the power head

- Remove the cover of the D-shape bowl.
- Rotate the locking handle, as shown in Fig. 11, counter-clockwise to loosen the power head.
- Move the power head into the desired position.
- Rotate the locking handle clockwise to tighten and secure the power head into position.

(2) Loading sample

- Position the power head for easy loading of the sample.
- Raise the outer sleeve of the lift-lock of the power head, as shown in Fig. 12-step 1.

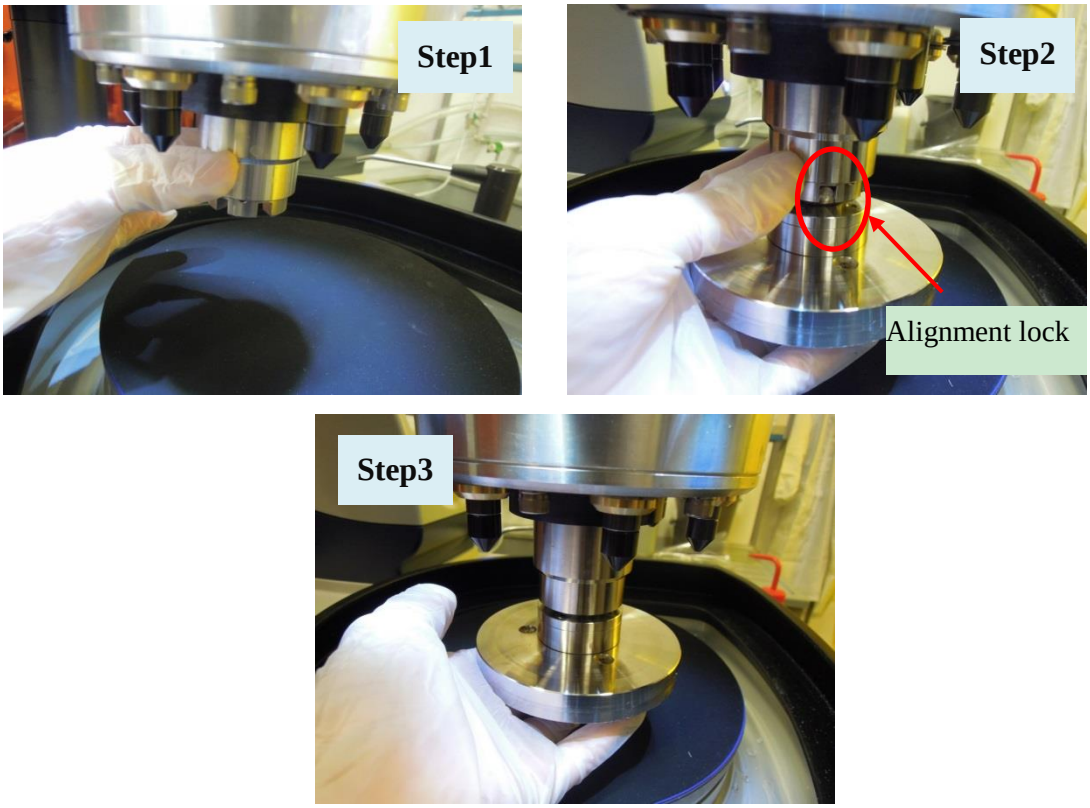


Fig. 12 Sample loading

- Insert the sample holder, and gently rotate it until it aligns to the lock, as shown in Fig.12-step 2.
- Release the outer sleeve of the lift-lock, the sample holder will be fixed to power head, as shown in Fig. 12-step 3.
- Check whether the sample holder is fastened or not by your hand.
- Position the polishing head and it is ready to begin the polishing cycle.

(3) Start the polishing process

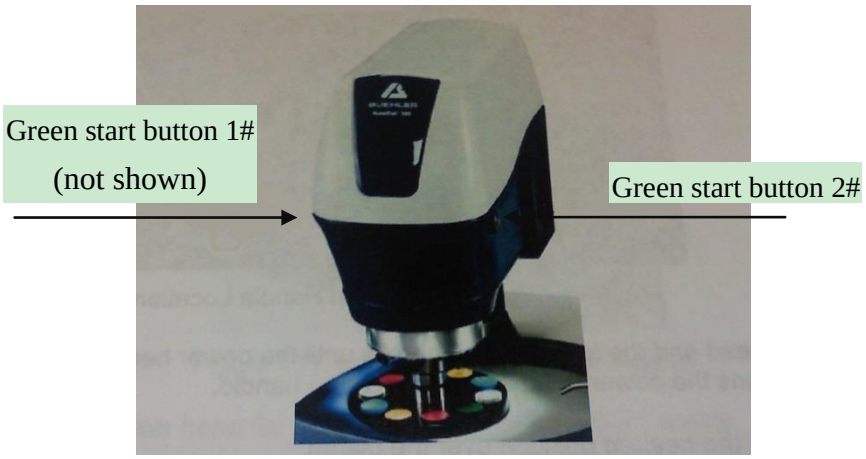


Fig. 13 Power head start buttons

- Before the process, spray proper lubricant and diamond suspension to the polishing pad and spread them by rotating the platen manually.
- The green power head start buttons are located on each side of the power head, as shown in Fig. 13.
- Simultaneously press both buttons, the power head will move toward the polishing pad and automatically stop when it touches the surface, then the polishing cycle is activated.
- The polishing cycle will stop when the setting time is up, and the polishing head will move to the original position automatically.
- Unload the sample and check the surface using microscope.
- Unloaded polishing cloth should be wiped clean using clean room papers and put it to the shelf and dry it.
- All the polishing cloths should be put into the plastic bags and put back into the cabinet according to their labels.
- Repeat the above polishing steps using suitable polishing cloth, slurry and

lubricant until the surface roughness is meet the requirement.

(4) Unloading and cleaning

- When process is finished, raise the lift-lock chuck and release the sample holder.
- Cleaning the D-shape bowl using DI water and wipe dry using dust-free paper.
- Move the power head to side and cover the D-shape bowl.
- Turn off the power buttons both in front panel and in backside.
- Turn off the DI water and N_2 flow.
- Pack the polishing clothes and put them back to original place.
- Put the slurry and lubricant bottles back.
- Turn off the dial gauge.
- Turn off the hotplate.

4.10 Process Recording during the process

1. Please be reminded you are required to fill all the details of the log sheets
2. However, if you fail to do this, a punishment will be given
3. Write down any problems or comments in the log sheets

4.11 Clean up

1. Clean the work table and make sure everything is back to the original place.
2. Turn off the dial gauge.
3. Turn off the hot plate.
4. Tie the garbage bag and put it outside the door to prevent the small particles from coming into air.

4.12 Check out

Check out the equipment in the NFF equipment reservation website immediately after use

4.13 Important Notice

- DON'T spray any water on the polishing cloth except using silica 0.06μm slurry.
- DON'T spray too much diamond suspensions and lubricant.
- DON'T mix the polishing cloth and the plastic bags.
- DON'T use any polishing cloth and slurry not from NFF.
- Increase the force gradually. DON'T increase a force with the step larger than 20LBS.
- If the sample is irregular shape, please polish the sharp corner using abrasive paper before wafer bonding to prevent damage of the polishing cloth.