Standard Operating Manual

NanoFactor NVG-200A Silicon Grinder

Contents

NanoFactor NVG-200A Silicon Grinder

1. Picture and Location

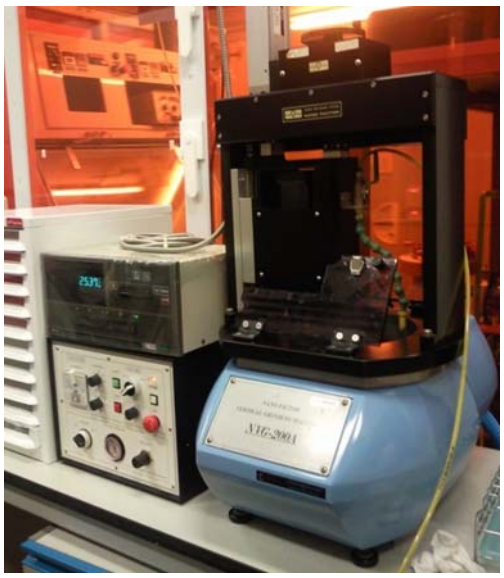


Fig.1 NanoFactor NVG-200A Silicon Grinder Machine

This tool is located at Room 2227.

2. Process Capabilities

2.1 Cleanliness Standard

NVG200A polisher is classified as a **Semi-Clean** equipment.

2.2 Possible Grinding Materials

Silicon, Silicon Oxide

2.3 Process Specification

What the NVG-200A CAN do

1. NVG-200A can provide mechanical grind of sample surface using diamond wheel.
2. NVG-200A can grind the samples with thickness from tens microns to several millimeters.
3. NVG-200A can grind the samples in any shape, with size smaller than 4 inch but need attach small sample to a 4” wafer.

What the NVG-200A CANNOT do

1. NVG-200A should not be used to polish a sample larger than 4 inches in diameter.
2. NVG-200A should not be used to grind a sample not bounded on our standard ceramic holder.
3. NVG-200A should not be used to grind a sample with metal.
4. NVG-200A should not be used to grind a sample with any photoresist coated on the surface.
5. NVG-200A should not be used to grind a sample with fine structures on the surface.

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. Yui Ming KAN – Technician (2358-7896&2358-7220)

3.2 Training to Become a Qualified NVG-200A User

Please follow the procedures below to become a qualified user of the NVG-200A:

1. Read through the on-line equipment operating manual of the equipment;

   http://www.nff.ust.hk/equipment-and-process/equipment-operation-manual.html.
2. Attend the equipment hand-on operation training either by peer or NFF staff.
3. If training is provided by NFF staff, user must log in NFF equipment reservation system, and register this training.
4. E-mail to Mr. Yui Ming KAN requesting NVG-200A qualified exam.
5. Pass the examination for the equipment operation and the security.

4. Operating Procedures

4.1 System Description

NanoFactor NVG-200A grinder is composed of grinding main body and control

panel. This system uses a rotating diamond grinding wheel to thin sample thickness with high accuracy in the order of micrometer. The sample needs to be bounded on a 4-inch ceramic holder using wax. Normally, 20~400μm removal of sample can be realized. Grinding wheel #300 with abrasive size of 50μm is used for Sapphire removal or thicker removal (>100μm) and results in coarse surface after grinding. Grinding wheel #800 with abrasive size of 15μm is suitable for more accurate removal and the resulted surface is smoother.

4.2 Safety Warnings

1. Follow NFF General Lab Safety policy.
2. If the equipment failure while being used, never try to fix the problem by yourself. Please contact NFF staffs.
3. 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.
4. During process, if something going wrong and you are not sure what happens, please report to NFF 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 grinding 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 grinding process unattended.

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. Power on the grinding machine and check the power lamp is on.
2. Check the changeover knob is switched to Manu side.
3. Check the model of grinding wheel (#300 or #800?).
4. Check the G.S. speed is ~300rpm.
5. Check the W.S. speed is ~150rpm.
6. Check the V. feed is ~2.
7. Manual running without any load to warm up for 30mins.
8. Please make sure the cooling water is flow normally.

4.6 Preparation before Grinding

A) Grinding wheel install

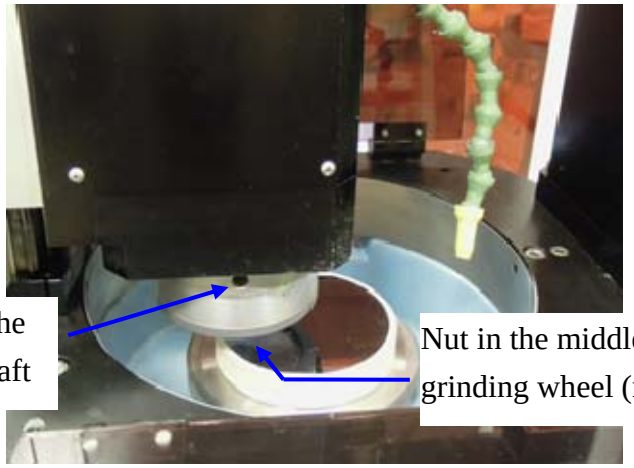


Fig. 2 Loading and un-loading the grinding wheel.

Un-loading: Insert Allen keys into the nut at bottom of the grinding wheel and the side-hole in the grindstone-shaft, as shown in Fig. 2. Loose the grinding wheel by moving them closer.

Loading: Put the nut into the center of the suitable grinding wheel and parallel the grinding wheel to the grindstone-shaft. Fix the Allen key in the center of the grinding wheel, then load and fasten the grinding wheel by rotating the Allen key in the side-hole counter-clockwise.

B) 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. 3, adjust the knob to position 6-7, wait for 3~5 minute.

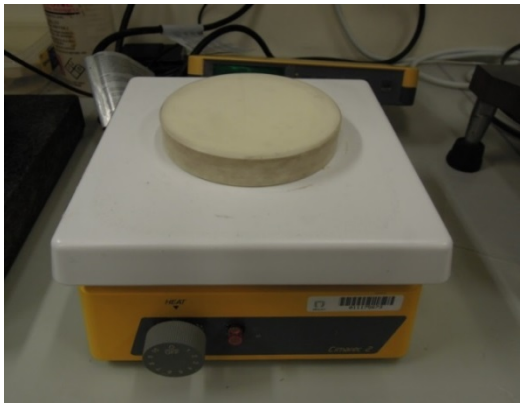


Fig. 3

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

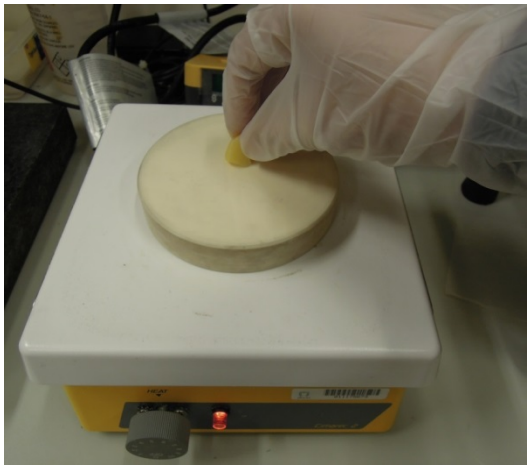


Fig. 4

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. 5.

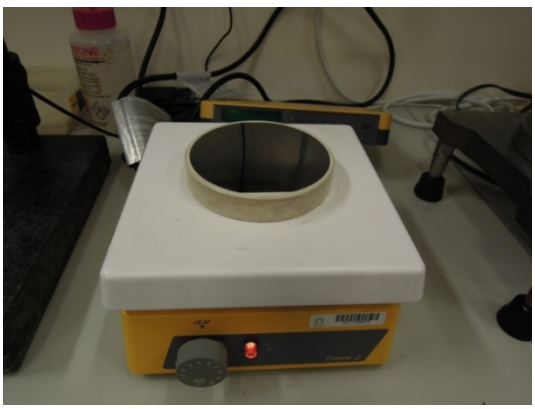
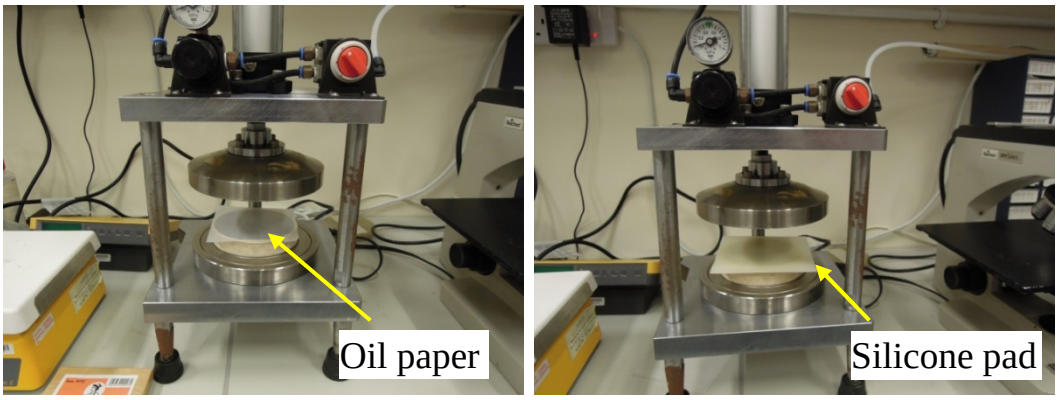


Fig. 5

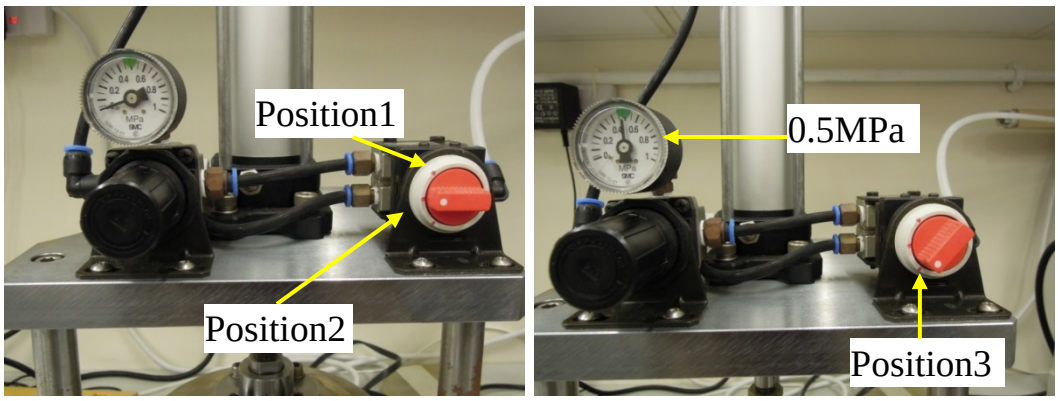
6) Move the ceramic holder onto the bonder very carefully, and put an oil-paper (Fig.6a) and a soft silicone pad on the top, as shown in Fig. 6b.



(a) (b)

Fig. 6

7) Switch the RED pneumatic button to horizontal (position 2), as shown in Fig. 7a, 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. 7b). DON'T adjust the pressure by yourself.



(a) (b)

Fig. 7

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) Measure the thickness or flatness using dial gauge, shown in Fig. 8.

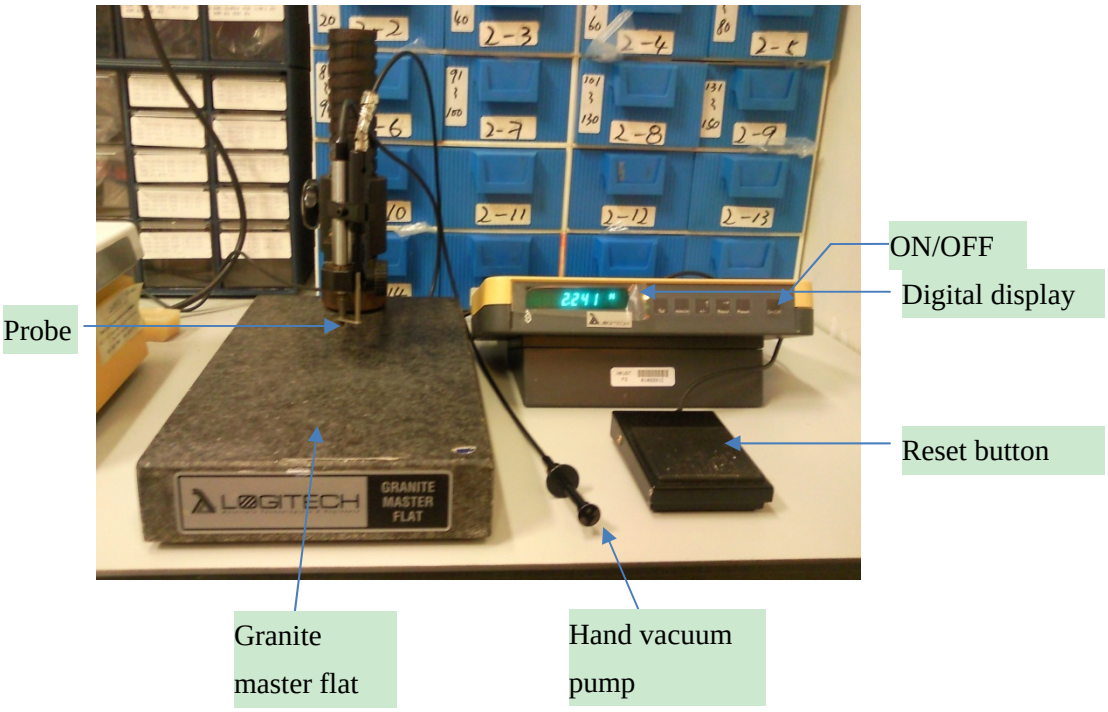


Fig. 8

- 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.

4.7 Control Panel Setting

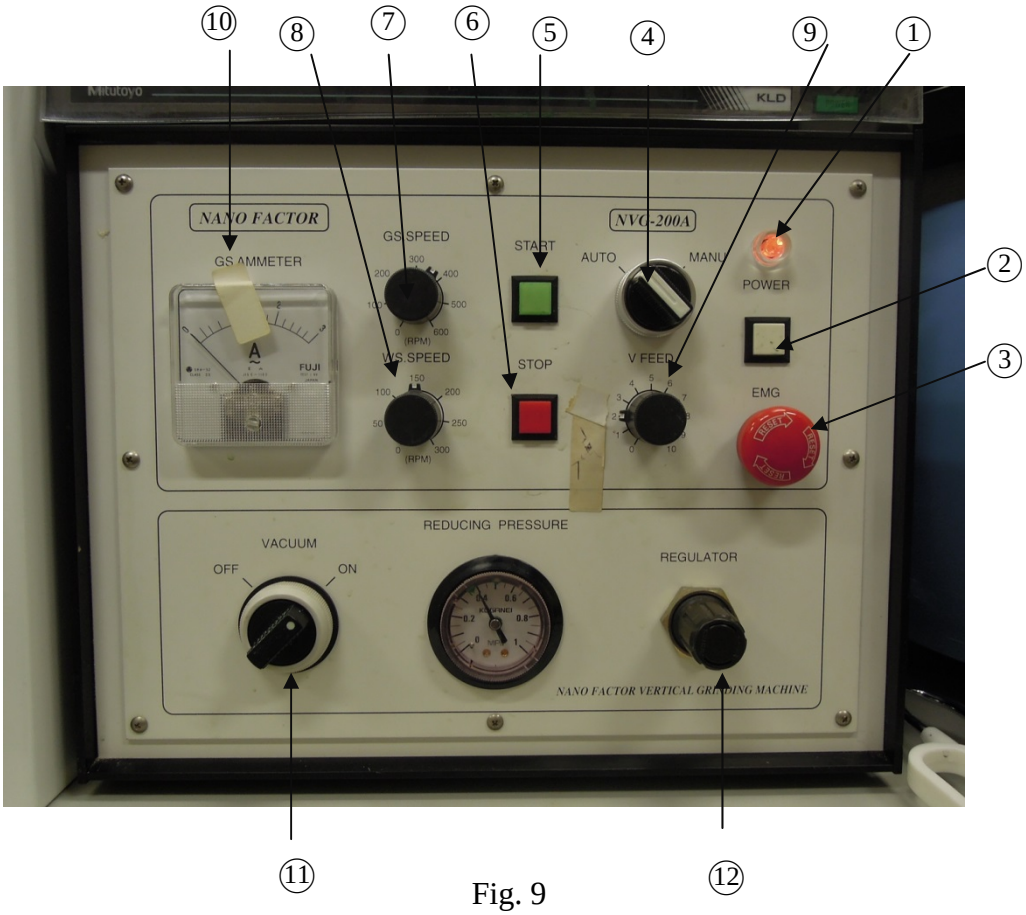


Fig. 9

①. Main-power lamp……..Goes on as the main power is connected

②. Main-power button……While this button is on, the grinding machine is in stand-by condition

③. EMG button……Locked emergency shutdown button

④. MANU/AUTO…….Changeover knob for changing between automatic and manual running

⑤. START button……For the start of the grinding machine

⑥. STOP button…….For the stop of the grinding machine

⑦. GS. SPEED CONTROL knob……..For adjustment of rotation of the grindstone shaft

⑧. WS. SPEED CONTROL knob…….For adjustment of rotation of the workpiece shaft

⑨.V.FEED CONTROL knob……For adjustment of downward feeding of the

grindstone shaft

⑩. GS. AMMETER……Ammeter for the grindstone shaft

⑪.VACUUM……for ON/OFF changeover of the vacuum chuck

⑫. REGULATOR……Reducing valve for backrush prevention

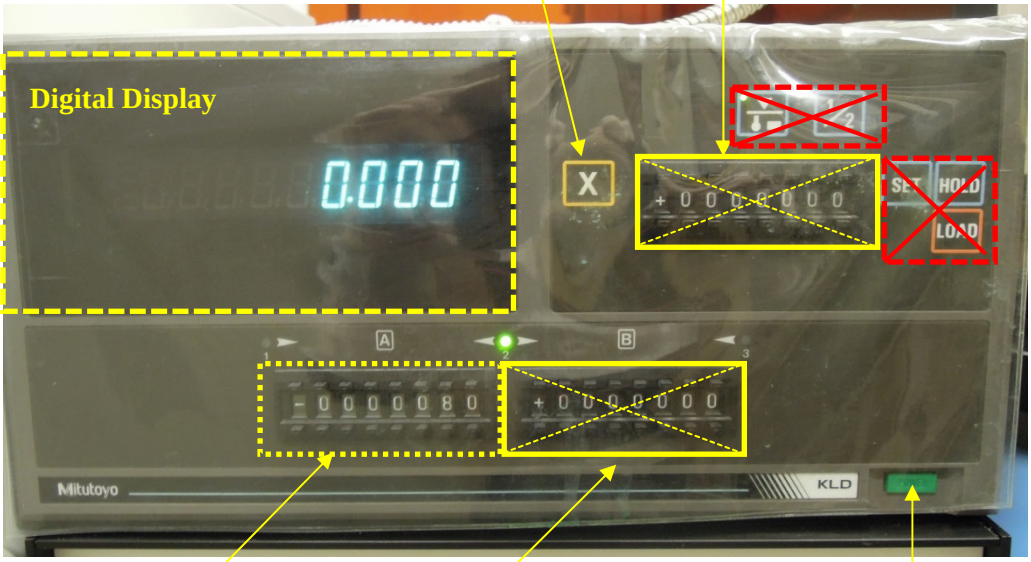


Fig. 10

4.8 Grinding Wheel Cleaning

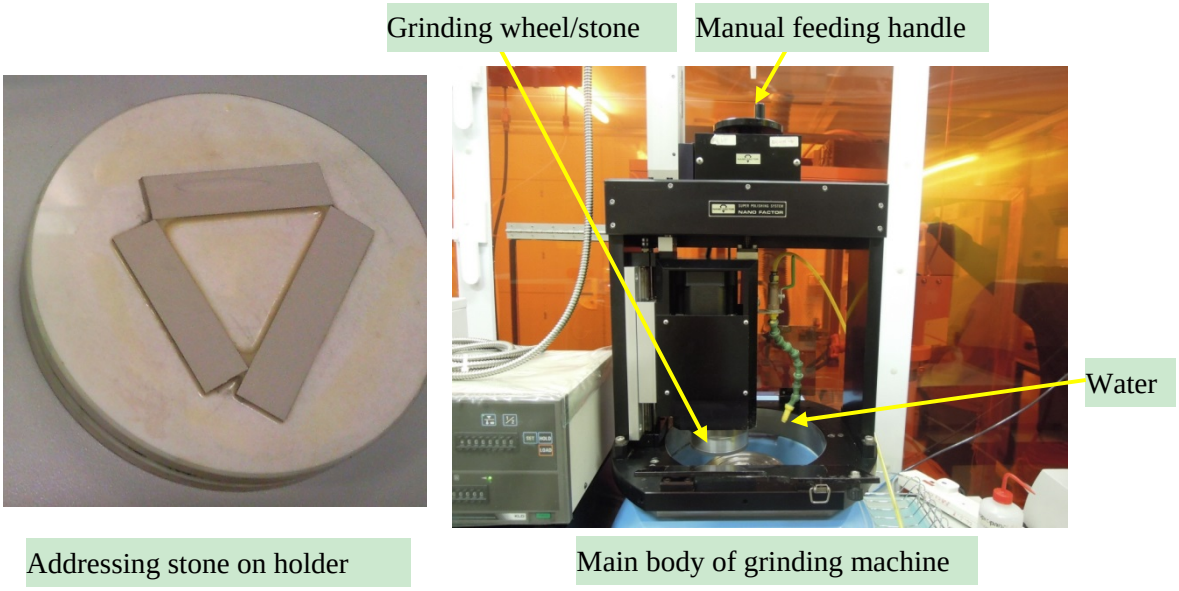


Fig. 11

[1]. Make sure that the electric cables are connected and the pneumatic power is ready for operation. Turn on the main power to warm up the system for 30mins.

[2]. Set the AUTO/MANU changeover knob to MANU. Move the grindstone-shaft spindle upward by the manual feeding handle. (For the auto mode, the manual feeding handle is locked and cannot be moved.)

[3]. Open the cover of the main body, and set the attached dressing grindstone to the center of the vacuum chuck.

[4]. Activate the vacuum chuck, and make sure that the dressing grindstone is securely fixed to the vacuum chuck. If the grindstone is movable by hand, clean the side contacting the chuck and reset it.

[5]. Put a piece of oil-paper on top of addressing stone.

[6]. Move the grindstone-shaft spindle down by operating the manual feeding handle until it lightly touches the dressing grindstone, and the oil-paper can't be moved any more. Set the linear gauge counter to 0 by press the button of "X".

[7]. Set the GS speed at 300rpm and the WS speed at 150rpm.

[8]. Move the grindstone-shaft upward and take out the oil paper. Move the wheel shaft downward to the position of Zero.

[9]. Set lower-limit point of grinding wheel to -70μm. Setting the automatic downward feeding speed (V. feed speed) to 2.

[10]. Switch the AUTO/MANU changeover knob to the AUTO side.

[11]. Make sure the cooling water nozzle is on top of the grinding stones and close the cover of the main body.

[12]. Then, push the start button to start dressing.

[13]. Listen to the rattle noise when the grinding wheel is touched on the dressing stone and write down the position of the touching point. Compared to the set lower-limit point to find out the real removal depth of grinding wheel. "-30~-40μm" stone removal is enough to clean the wheel. If the real touch point is larger than "-50", you should do the wheel cleaning one more time with increasing the lower-limit point to ensure ""-30~-40μm" removal of grinding wheel and dressing stone.

[14]. When the counter reaches -70μm, spark-out is carried out for 5 seconds as set by the built-in timer, and the machine is reset and stops at the original position.

[15]. Switch the changeover knob to MANU, and move the wheel shaft upward. Then, turn off the vacuum, and open the main body cover to take out the dressing stone.

[16]. Clean the dressing stone using DI water and wipe dry using clean room paper or N_2 gun. Put it back to the drawer.

4.9 Sample Grinding

[1]. Set the AUTO/MANU changeover knob to MANU. Move the grindstone-shaft spindle upward by the manual feeding handle. (Optional)

[2]. Open the cover of the main body, and set the sample to the center of the vacuum chuck.

[3]. Activate the vacuum chuck, and make sure that the sample is securely fixed

to the vacuum chuck by moving it by hand.

[4]. Put a piece of oil-paper on top of sample.

[5]. Move the grindstone-shaft spindle down using the manual feeding handle until it lightly touches the sample surface, and the oil-paper can't be moved any more. Zeroing this position by pushing "X" button.

[6]. Move the grindstone-shaft upward and take out the oil paper. Move the wheel shaft downward to the position of Zero.

[7]. Set the GS speed at 400rpm and the WS speed at 150rpm.

[8]. Set the grinding depth (~30-100μm). Setting the automatic downward feeding speed (V. feeding speed) to 1-2.

[9]. Switch the AUTO/MANU changeover knob to the AUTO side.

[10]. Make sure the cooling water nozzle is on top of the grinding stones and close the cover of the main body

[11]. Then, push the start button to start the grinding process.

[12]. Watch out the current showing on the Ammeter. Reduce the G.S speed and V- feed speed and don't let the reading exceed 1 Amp during the grinding process.

[13]. When the counter reaches the setting depth, spark-out is carried out for 5 seconds, and the machine is reset and stops at the original position.

[14]. Switch the changeover knob to MANU, and move the wheel shaft upward. Then, turn off the vacuum, and open the main body cover to take out the sample.

[15]. Clean the sample using DI water and wipe dry using clean room paper or N_2 gun.

[16]. Check the wafer thickness and uniformity by the dial gauge.

[17]. Repeat the steps 8-16, until the wafer thickness is reached the desired value.

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. Cleaning the grinding main body using dust-free paper.
2. Turn off the power button of NVG-200A.
3. Turn off the power button of dial gauge.
4. Detached the wafer on hot-plate.
5. Turn off the power of hotplate.
6. Clean the work table and make sure everything is back to the original place.
7. 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 or equipment card reader immediately after use.

4.13 Important Notice

- The W.S. speed is fixed at 150rpm. Do not change it.
- Watch out the current showing on the GS Ammeter. Reduce the G.S speed and V- feed speed and don’t let the reading exceed 1 Amp during the grinding process.
- Check the wafer thickness and uniformity in middle of your grinding process

for several times. Don’t set the depth increase larger than ~100μm for each cycle.

- Too large V-feed speed will crack the sample easily. Please counting the material removal rate not larger than 1μm/2second.