



# Cross Section Polisher

## CP-8000+ Operation Manual



COXEM Co., Ltd.

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- Read operation manual before using the product to understand how to use it. Make sure to keep operation manual in a conspicuous place.
- Some devices and functions described in operation manual may not be provided and may vary according to selected specification items or options.
- Images on operation manual cover and body may differ from those of actual product.
- Functions or performances of this product may change without prior notice.

## 1. Introduction

### 1.1 Specification

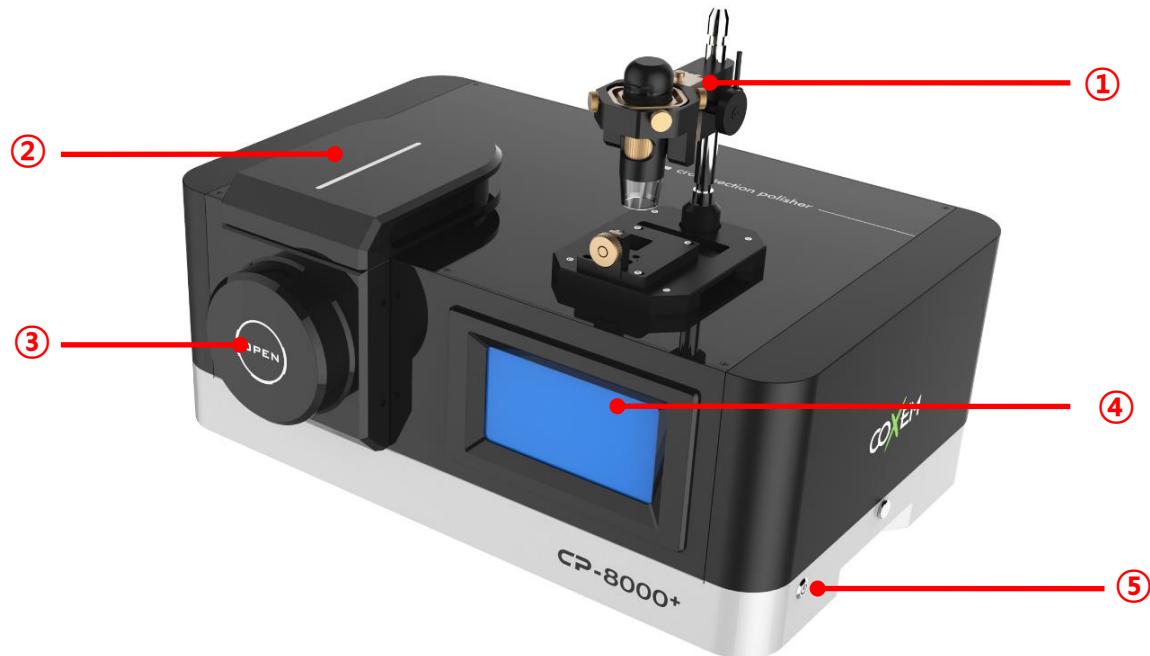
Refer to a table below for CP-8000+ product specification.

|                      |   |
|----------------------|---|
| Gas Used             | Ar(argon) gas                                       |
| Gas Purity           | Ar Gas B(99.995) to Ar Gas S(99.999)                |
| Milling Speed        | 500um/h(Si at 8kV)                                  |
| Accelerating Voltage | 2kV~8kV   |
| Beam Diameter        | Approx. 800um                                       |
| Beam Alignment       | Precision beam alignment using fluorescent screen   |
| Maximum Sample Size  | 16(W)x10(D)x9.5(H)mm / 20(W)x10(D)x5.5(H)mm         |
| Rotation             | ±35°  |
| Operation            | Touch panel,(7 inch display)                        |
| Evacuation System    | Turbo-molecular pump(66L/s), Diaphragm pump(0.4L/s) |
| Dimension            | 607(W) X 472(D) X 277.5(430.5)(H)mm                 |
| Weight               | Main System: 36kg / Diaphragm Pump: 6.5kg           |

## 1.2 Description of parts of this product

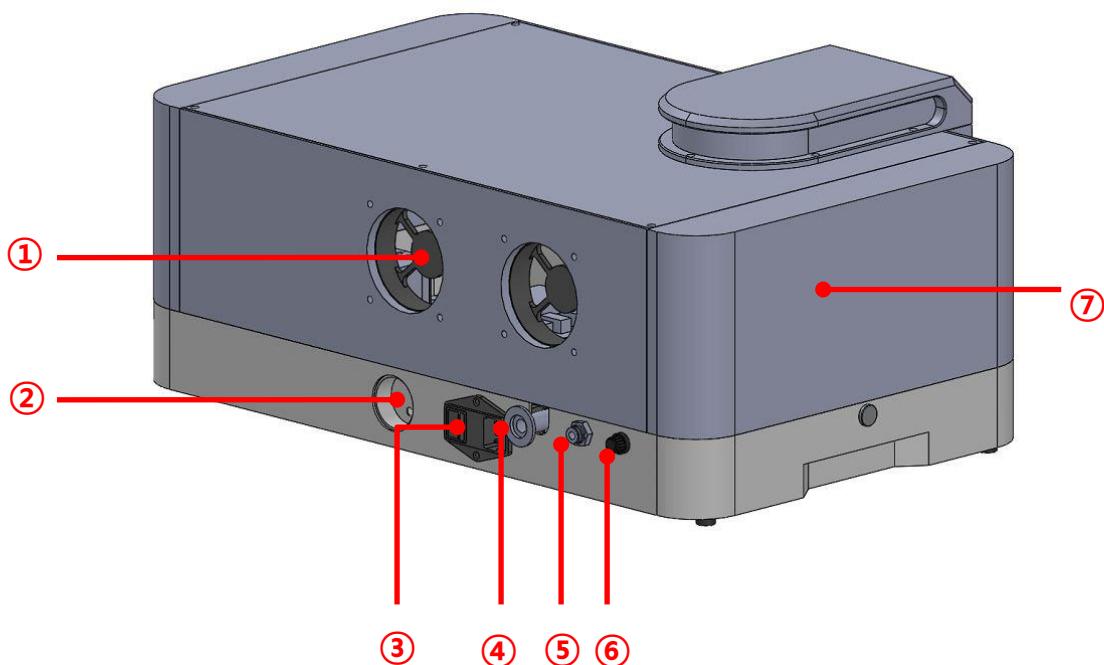
Describe names and functions of parts of CP-8000+ product.

### 1.2.1 CP-8000+ the front



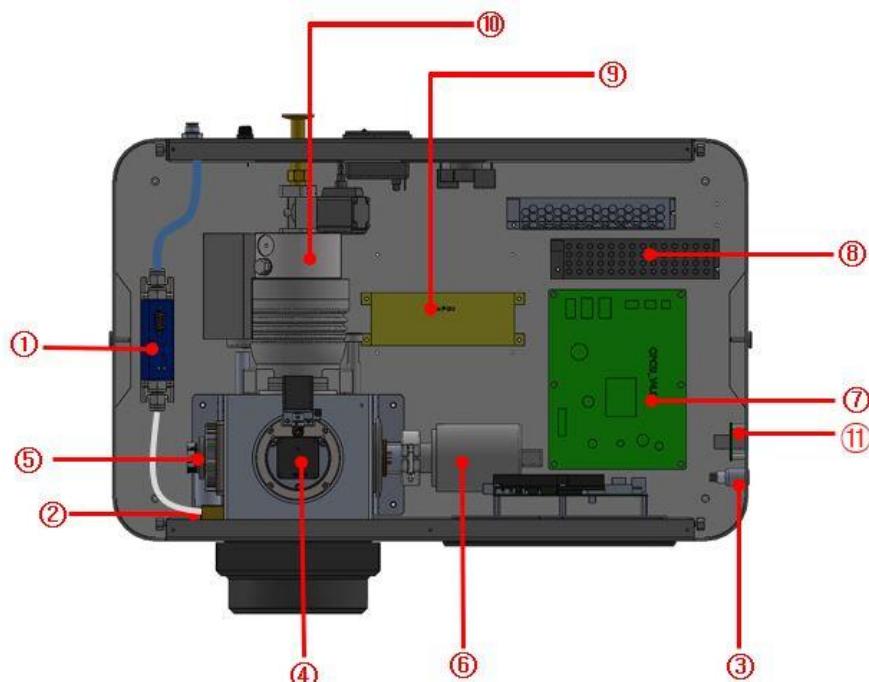
| No. | Items              | Description                               |
|-----|--------------------|---|
| ①   | Microscope         | Microscope for observing sample condition |
| ②   | CCD cover          | CCD embedded cover                        |
| ③   | Chamber door cover | Chamber door cover for loading samples    |
| ④   | LCD                | LCD touch panel for product UI DISPLAY    |
| ⑤   | Side power switch  | Supply secondary power for this product.  |

## 1.2.2 CP-8000+ the back



| No. | Items                    | Description  |
|-----|--------------------------|--|
| ①   | Cooling fan (IN/OUT)     | Cool the inside of equipment.                                  |
| ②   | Rotary pump outlet       | Connect rotary pump power.                                     |
| ③   | Power switch and outlet  | Play a role of connecting product power and turning On/Off it. |
| ④   | Rotary pump connection   | Part that is connected to rotary pump.                         |
| ⑤   | Gas inlet                | Part that gas is injected.                                     |
| ⑥   | Fuse                     | Shut off overcurrent of outside.                               |
| ⑦   | Flow control valve cover | Cover for flow control valve.                                  |

## 1.2.3 CP-8000+ inside



| No. | Items               | Description  |
|-----|---------------------|--|
| ①   | MFC                 | Control gas flow                                       |
| ②   | Solenoid valve      | Turn Gas Injection On/Off .                            |
| ③   | Power switch        | Power switch for operation                             |
| ④   | CCD Camera          | Observe shape of sample and beam                       |
| ⑤   | Ion gun             | Generate and emit ion beam.                            |
| ⑥   | Penning gauge       | Measure vacuum level in a chamber                      |
| ⑦   | Main Board          | CP driving electronic board.                           |
| ⑧   | 24V SMPS            | Internal electronic board and turbo pump driving power |
| ⑨   | High voltage module | High voltage power                                     |
| ⑩   | Turbo pump          | High vacuum maintenance pump                           |
| ⑪   | UBS connector       | Microscope connection                                  |

## 1.3 Procedures for operating this product

1torr=1.333mbar=133.322pa

Procedures for operating CP-8000+ are as outlined below.

| Steps |                                | Automatic/Manual | Details   |
|-------|--------------------------------|------------------|---|
| 1     | Preparing samples              | Manual           | Making samples<br>Mounting samples  |
| 2     | Power ON                       |                  | Turning on product power  |
| 3     | Preparing ion beam             |                  | Setting acceleration voltage<br>Setting swing angle<br>Setting etching time<br>Setting Auto Beam On/Off |
| 4     | START                          |                  | Proceeding with etching procedures automatically after pressing START button                            |
| 5     | Stage Homing                   |                  | Stage moves to homing position  |
| 6     | Injecting Ar GAS               |                  | Starting Ar Gas Injection after satisfying vacuum level (8x10 <sup>-6</sup> Torr)                       |
| 7     | Turning on ion beam emittance  |                  | Proceeding with ion beam emittance  |
| 8     | Measuring ion beam             |                  | Measuring ion beam current value  |
| 9.    | Moving stage                   |                  | Stage moves to ion beam position  |
| 10    | Etching samples                |                  | Etching samples   |
| 11    | Turning off ion beam emittance | Automatic        | Turning off ion beam after etching ends   |
| 12    | Stage Homing                   |                  | Stage moves to Home position  |
| 13    | Ending                         |                  | Keeping vacuum condition ( T/P OFF in case that there is no operation for five minutes)                 |
| 14    | Removing samples               |                  | Removing samples in a state of atmospheric pressure after touching VENT button                          |
| 15    | Turning on                     | Manual           | Pump after checking of a chamber is empty.  |

|    |                   |  |                           |
|----|-------------------|--|---------------------------|
|    | vacuum            |  |                           |
| 16 | Turning off power |  | Turning off product power |

## 1.4 Precautions before use

### 1.4.1 Handling

If fine dust or alien substance enters CP-8000+, it may cause deterioration of performance of equipment. Make sure to wear sanitary gloves before handling equipment.



**Example of sanitary gloves**

#### 1.4.2 Authority for use according to work

You need to control CP-8000+ with authority when controlling CP-8000+.

| Classification of work                 | Details  |
|--|--|
| General operation and execution        | Operator who completed a training for how to use this product                  |
| Cleaning a product and replacing ion   | Operator who completed a training for how to use this product                  |
| Replacing hardware parts               | Person who completed a training for maintenance at a manufacturer or an agency |
| Disassembling hardware and maintenance | Person who completed a training for maintenance at a manufacturer or an agency |

### 1.4.3 Safety precautions

Matters that you need to know before using CP-8000+ are as outlined below.

| Items   | Description   |
|---------|---|
| WARNING | If a user fails to follow directions, he/she may be seriously injured or may lose his/her life. |
| CAUTION | If a user fails to follow directions, he/she may be injured or experience property damage.      |

#### **WARNING**

- Ion gun part is in a state of high pressure. If you touch it by hand without safety equipment, you may suffer from electric shock or get scalded. Do not connect or detach a cable while ion gun is in operation.
- Do not touch ion gun part by hand with product power on. If mechanical pressure is applied to electric cable, it may cause electric shock or fire. Do not pull, bend or twist a cable.
- Ar(Argon) gas which is inert gas may cause death from respiratory difficulty when it is leaked in a sealed space. If gas barrel falls, it may lead to gas leak and thus fix it firmly to prevent it from moving.
- If a pump operates, it causes temperature of surface to rise. While a product is in operation, avoid placing ignitable or inflammable substance around a pump.

### Cautions

- If this product is exposed to excessively high temperature, it may cause malfunction of this product. To prevent this product from breaking down, keep indoor appropriate. (proper temperature of  $22\pm3^{\circ}\text{C}$ , proper humidity of 60% or lower)

- If this product is kept in excessively low temperature, it may cause malfunction of electronic parts in a board.

This product should be kept in proper temperature.

- Avoid installing or storing this product on a floor with excessive vibration.

- When opening or closing sample chamber, open or close it slowly with both hands to prevent hands from being injured.

- Make sure to use equipment as directed in operation manual. If you fail to do so, it may cause malfunction of or damage to equipment.

If you intend to move equipment, it is advisable that you should request service. If a user moves or installs equipment arbitrarily, it may cause malfunction of or damage to equipment. For malfunction caused by a user's arbitrary movement or installation, after sales service expense will incur.

- Avoid modifying or altering hardware arbitrarily. If you alter equipment arbitrarily, it may cause fire or electric shock. For malfunction caused by a user's arbitrary modification or alteration, after sales service expense will incur.

- If Ar(Argon) gas barrel fails to be fixed firmly, it may fall causing a user to be injured or parts to be damaged.

## 2. Composition of HW

### 2.1 CP-8000+ main body

CP-8000+ main body is connected to diaphragm pump.



### 2.2 Ar Gas and regulator (Optional)

Ar gas needs to be injected to generate CP-8000+ Ion Beam.

\* Be careful not to use Ar Gas with poor purity.

|                    |                 |
|--------------------|-----------------|
| Set pressure value | 0.1Mpa          |
| Purity             | 99.995%~99.999% |

Figure below shows a regulator for controlling and checking Ar Gas.



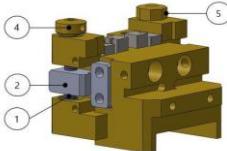
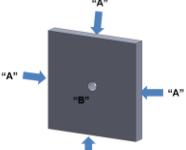
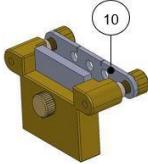
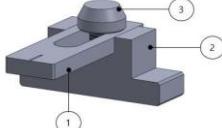
## 2.3 Microscope



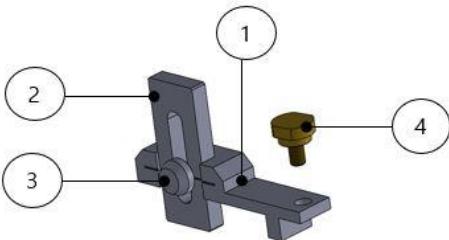
Optical microscope is attached to CP-8000+ main body.

Refer to [5.1.2 how to use microscope] for operation of microscope.

## 2.4 Normal Milling Sample Holder Set

| Model                                      | Image   | Note          |
|--|---|---------------|
| Sample holder                              |    | Qty: 1EA      |
| Sample mask                                |    | Qty: 3EA      |
| Mask fixing jig                            |    | Qty: 3EA      |
| Sample holder fixing plate A               |  | Qty: 1EA      |
| Sample holder fixing plate B               |  | Qty: 1EA      |
| Sample holder fixing plate C               |  | Qty: 1EA      |
| Beam position jig                          |  | Qty: 1EA      |
| Height adjusting jig<br>(30um, 50um, 80um) |  | Qty: each 1EA |

## 2.5 Flat Milling Sample Holder Set

| Model                  | Image   | Note     |
|------------------------|---|----------|
| Flat Stage             |    | Qty: 1EA |
| Beam position sight    |   | Qty: 1EA |
| Sample fixing plate    |   | Qty: 1EA |
| Sample attaching plate |  | Qty: 1EA |
| FLAT sample holder     |  | Qty: 1EA |
| FLAT sample holder     |  | Qty: 1EA |

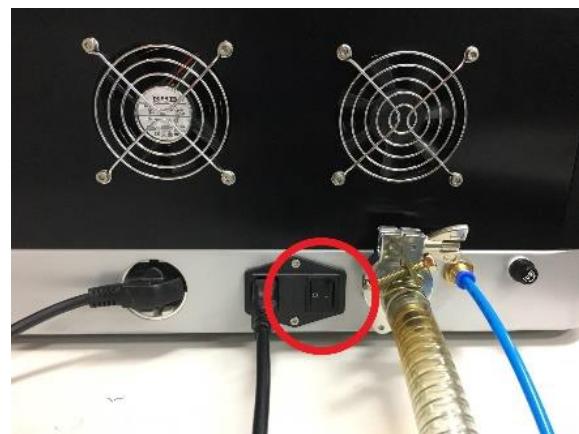
### 3. Composition of UI

#### 3.1 Power ON

Supply power to this product before finding composition of UI .

##### 3.1.1 Main Power ON

Turn on main power switch at the back of CP-8000+.



##### 3.1.2 Secondary power switch ON

Press secondary power switch long on the right of CP-8000+ to turn on power.



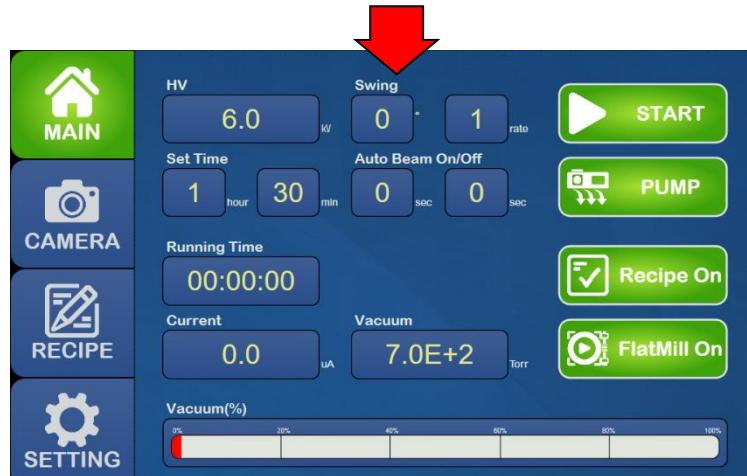
If you apply secondary power to CP-8000+, PC will start booting.

Wait until SW executes after PC booting.

STEP 1. Screen showing early part of booting



STEP 2. Screen showing OS loading



STEP 3. SW screen

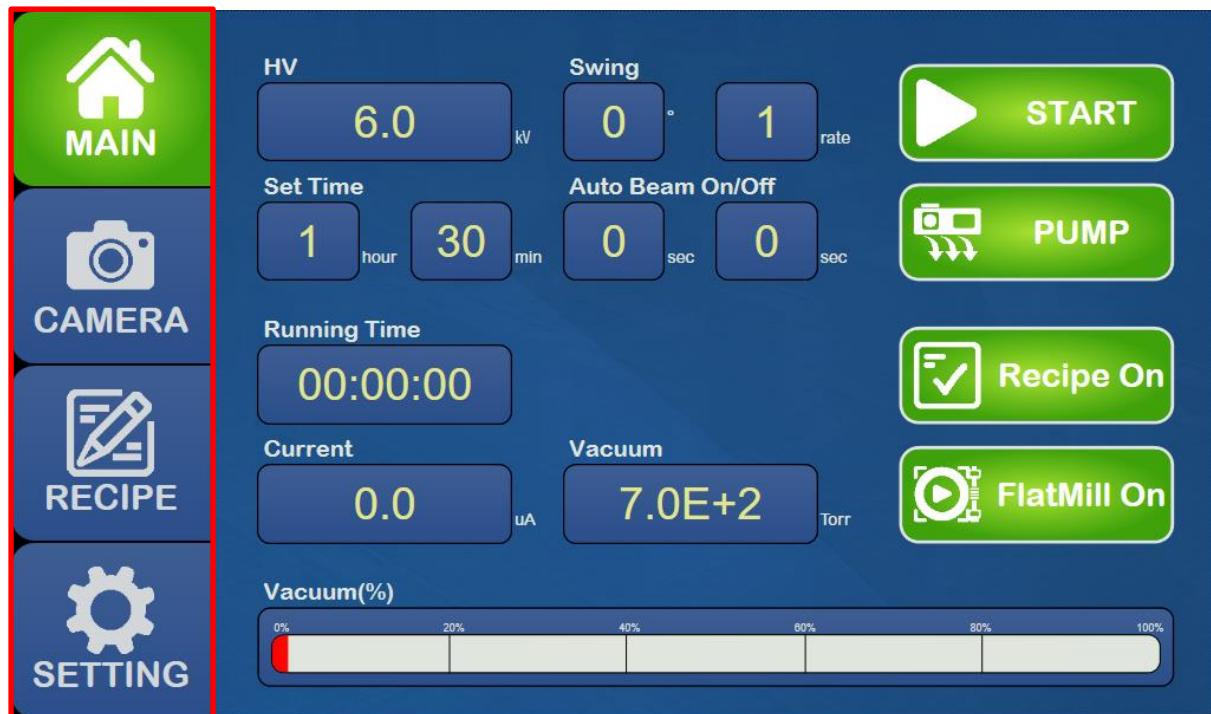
This procedure takes about one minute after power is applied to this product.

You can use this product after SW is executed normally.

After power is applied for the first time, you need to press PUMP button to keep vacuum condition.

\* In the event that booting or SW is not executed, ask service center.

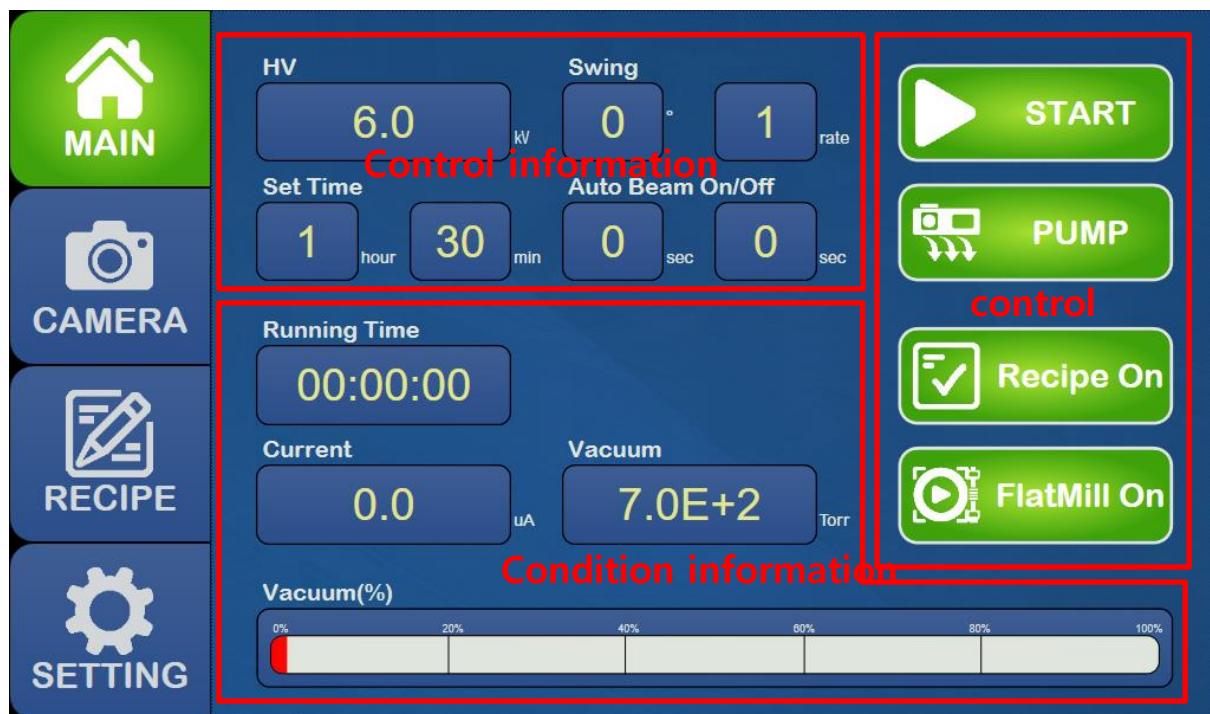
### 3.2 MENU



| Name    | Description   |
|---------|---|
| MAIN    | Display control information, condition information and control button |
| CAMERA  | Output and control chamber and sample camera image                    |
| RECIPE  | Display control information list                                      |
| SETTING | Input control information   |

### 3.3 MAIN

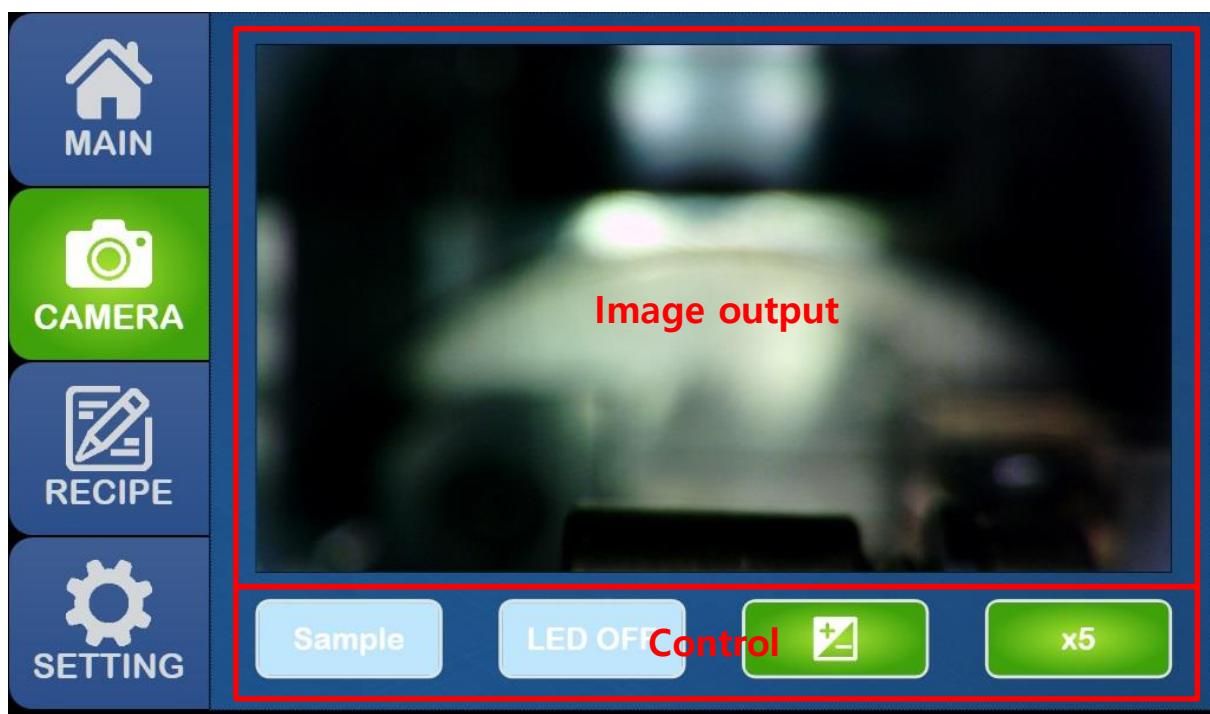
This allows you to check predetermined control information and equipment condition information and to enter control command.



| Category              | Name            | Description  |
|-----------------------|-----------------|--|
| Control information   | HV              | Display high voltage and predetermined acceleration voltage              |
|                       | Swing           | Display predetermined swing angle and speed                              |
|                       | Set Time        | Display predetermined operation time                                     |
|                       | Auto Beam       | Display set value of auto beam function                                  |
| Condition information | Running Time    | Display lapsed operation time  |
|                       | Current         | Display current value  |
|                       | Vacuum          | Display vacuum level   |
| Control               | START/STOP      | Button for proceeding with/stopping etching                              |
|                       | PUMP/VENT       | Button for converting to vacuum condition/atmospheric pressure condition |
|                       | Recipe On/Off   | Button for applying/not applying recipe                                  |
|                       | FlatMill On/Off | Button for operating/stopping Flat Milling                               |

### 3.4 CAMERA

This allows you to convert and print out chamber and sample camera image. Chamber camera image allows you to adjust LED, brightness and magnification. Sample camera image allows you to adjust magnification.



| Name           | Description                             |
|----------------|---|
| Image output   | Chamber/Sample camera image output      |
| Chamber/Sample | Chamber/Sample camera conversion button |
| LED ON/OFF     | LED On/Off control button               |
| Exposure       | Exposure control button                 |
| x5/x10/x20/x40 | Magnification change button             |

### 3.5 RECIPE

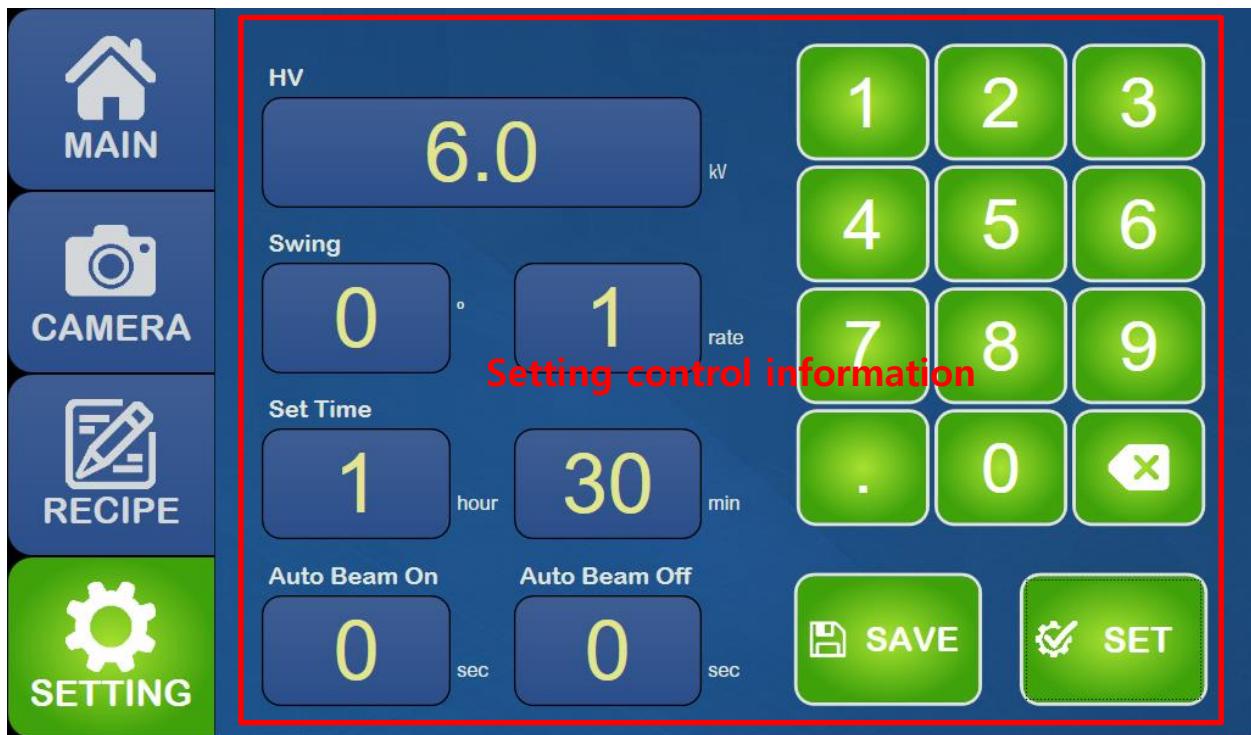
This allows you to print out stored control information list, apply or delete stored control list.



| Name        | Description   |
|-------------|---|
| Stored list | When a user touch save button on SETTING page, information is added to a list |
| ▲▼          | Change the order of items   |
| Apply       | When a user touches a button, it will be applied to MAIN page                 |
| Delete      | Delete information from a list  |

### 3.6 SETTING

This allows you to save or set control information.



| Name     | Description   |
|----------|---|
| HV       | High Voltage. Predetermined Acceleration voltage value input box. 2.0kV ~ 8.0kV |
| Swing    | Predetermined swing angle and speed input box. 0 ~ 35°, 1 ~ 4rate               |
| Set Time | Predetermined operation time input box. 0 ~ 99hour, 0 ~ 59min                   |
| AutoBeam | Predetermined auto beam function value input box. 0 ~ 59sec                     |
| KeyPad   | Button for inputting numbers  |
| SAVE     | Button for saving RECIPE  |
| SET      | Button for setting MAIN   |

## 4. UI operation

### 4.1 Setting control value (Setting control value on MAIN menu)

- 1) Touch setting button in a menu on the left to convert to SETTING page.



- 2) Use number pad in each input box in HV, Swing, Set Time, AutoBeam to enter set value.
- 3) When finishing all input, touch SET button.
- 4) Touch MAIN button in a menu on the left to convert to MAIN page.



- 5) Check if set value is displayed on the screen.

## 4.2 Storing control value (Storing control value on RECIPE menu)

- 1) Touch SETTING button in a menu on the left to convert to SETTING page.



- 2) Use number pad in each input box in HV, Swing, Set Time, AutoBeam to enter set value .
- 3) When finishing all input, touch **SAVE** button.
- 4) Touch RECIPE button in a menu on the left to convert to RECIPE page .



- 5) Check if set control value is displayed on the list.

#### 4.3 Applying control value (Importing RECIPE list to MAIN menu)

- 1) Touch RECIPE button in a menu on the left to convert to RECIPE page .
- 2) Check if there exists stored control value on a list.



- 3) Select one on a list by touching it and touch Apply button.
- 4) Touch MAIN button in a menu on the left to convert to MAIN page.



- 5) Check if applied control value is displayed on the screen.

#### 4.4 Deleting control value (Deleting RECIPE list)

- 1) Touch RECIPE button in a menu on the left to convert to RECIPE page .
- 2) Check if there exists stored control value on a list .
- 3) Select one on a list by touching it .



- 4) Touch Delete button to delete it.



- 5) Check if information has been deleted on a list.

## 4.5 Changing the order of control value list (Changing the order of RECIPE list)

- 1) Touch RECIPE button in a menu on the left to convert to RECIPE page .
- 2) Select one of recipes which you intend to change the order of a list by touching it.



- 3) Touch buttons to change the order of a list.

## 4.6 Camera image output

- 1) Touch CAMERA button in a menu on the left to convert to CAMERA page.



- 2) In case that PUMP/VENT button on MAIN page is in a state of VENT, sample camera image is printed out automatically.



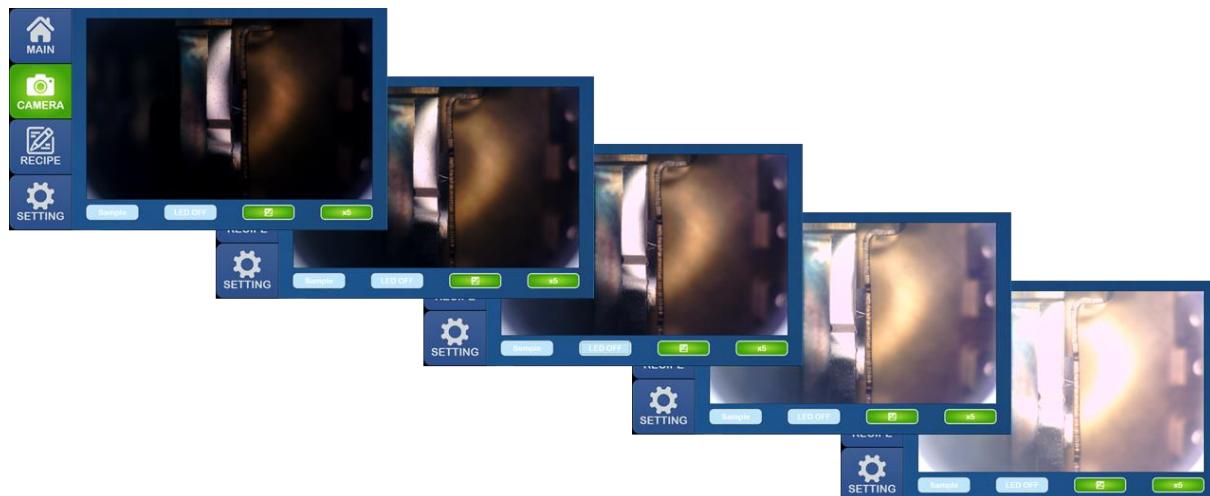
- 3) Magnification is changed in the order of x5 → x10 → x20 → x40 → x5 according to the number of touch.
- 4) Touch PUMP button on MAIN page to convert to vacuum condition.
- 5) Touch CAMERA button in a menu on the left to convert to CAMERA page.



- 6) In case that PUMP/VENT button on MAIN page is in a state of PUMP, chamber camera image is printed out automatically.
- 7) If you touch LED ON button at the center of bottom, you can convert to LED OFF state.

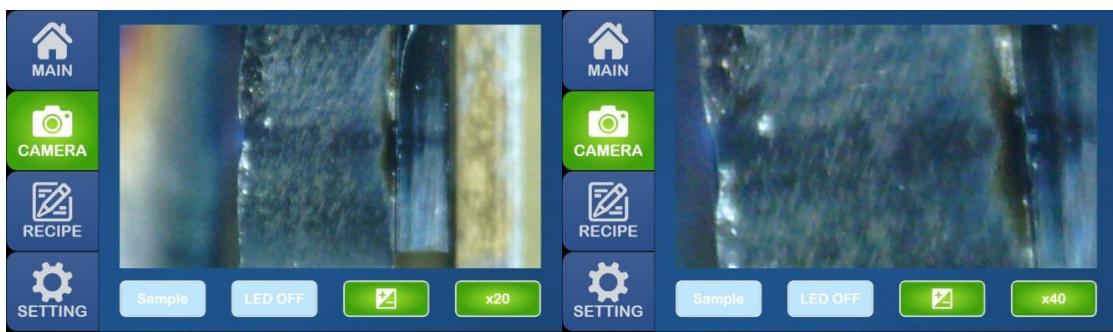


- 8) Touch magnification button one by one to magnify/reduce in the order of x5 → x10 → x20 → x40 → x5.



- 9)  exposure button consists of 1 to 5 steps according to the number of touch.

Set a state of brightness you want. (exposure default is set to third step.)



- 10) If you drag a screen by touching it in magnified state, you can move digital zoom screen.

## 4.7 PUMP / VENT operation

- 1) Touch MAIN button in a menu on the left to convert to MAIN page.



- 2) Touch PUMP button to convert to vacuum condition.
- 3) Check present degree of vacuum through value of degree of vacuum and progression bar.



- 4) Touch VENT button to convert to atmospheric condition.
- 5) Check present degree of vacuum through value of degree of vacuum and progression bar .

## 4.8 Starting etching

- 1) Touch MAIN button in a menu on the left to convert to MAIN page.
- 2) Check control value.



- 3) Touch START button to start operation.
- 4) In case that it is in atmospheric condition, PUMP button is changed to VENT and convert to vacuum condition.



MFC 被激活，真空度略微下降，电流值上升运行时间开始。

- 5) If conversion is completed in vacuum condition, MFC is activated degree of vacuum lowering slightly current value rising running time starts.
- 6) Touch CAMERA button in a menu on the left to convert to CAMERA screen.



- 7) Check beam output with the naked eyes on chamber camera with LED OFF .
- 8) In case that AutoBeam has been set, check On/Off time on Beam.
- 9) In case that Swing has been set, click LED ON button to check stage rotation angle.

## 4.9 Stopping etching

- 1) Touch MAIN button in a menu on the left to convert to MAIN page.



- 2) Touch STOP button during etching to stop it.
- 3) Touch CAMERA button in a menu on the left to convert to CAMERA page.



- 4) You can check Beam Off condition on Chamber camera with LED OFF .

## 4.10 Ending etching

- 1) Touch MAIN button in a menu on the left to convert to MAIN page .
- 2) If Running Time reaches Set Time, etching ends and converts to START button state and current value is printed out 0.
- 3) Keep Pump condition.



---

In case that no command is entered after etching ends, sleeping mode starts automatically to prevent a pump from overheating.

(In case of sleeping mode, Turbo Pump turns off and only diaphragm pump operates.)



We recommend that you press PUMP button after VENT to keep vacuum condition of this product if you intend to leave it unattended for a long period.

---

## 4.11 Recipe operation

- 1) Touch RECIPE button in a menu on the left to convert to RECIPE page .



- 2) Check Recipe list.
- 3) Touch MAIN button in a menu on the left to convert to MAIN page .



- 4) Touch Recipe On button.



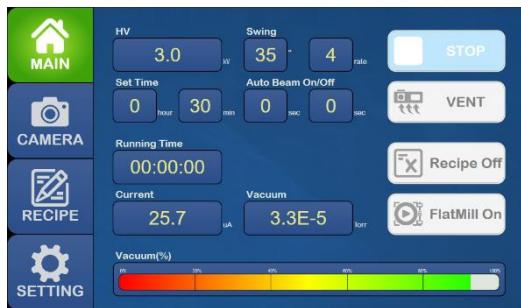
- 5) Check if control value of first item among Recipe lists has been set.



- 6) Touch START button to start etching.



- 7) After first Recipe operation is completed, operate as second Recipe set value.



- 8) After second Recipe operation is completed, operate as third Recipe set value .



- 9) After all Recipe operations are completed, check ending status.



After finishing Recipe etching, press Recipe Off button to restore etching mode setting.  
(Recipe On Mode is one-time and cannot proceed continuously.)

(配方开启模式是一次性的，不能连续进行。)

## 5. Composition of microscope & CCD

CP-8000+ consists of microscope for checking beam position from outside a chamber and CCD camera inside a chamber.

Camera tab enables a user to check situation in real time.

Microscope

|            |  |
|------------|--|
|            | <br>MAIN<br>CAMERA<br>RECIPE<br>SETTING<br>Chamber<br>LED ON<br>x5 |
| Microscope | Screen showing microscope observed through camera tab              |

CCD

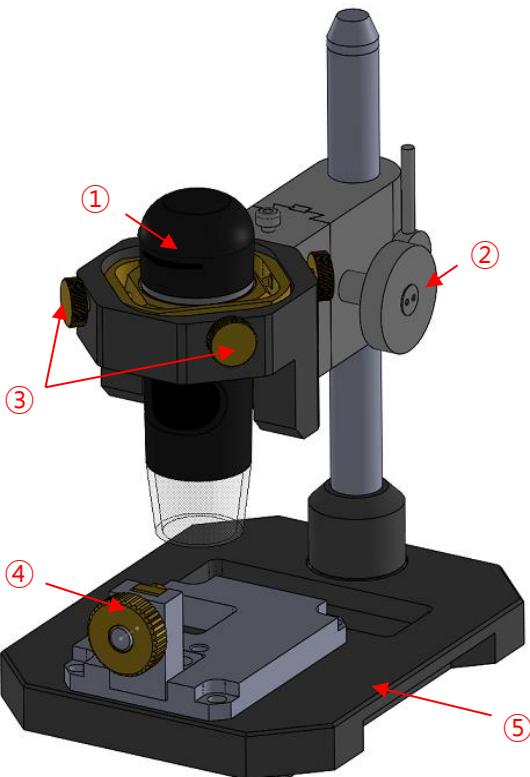
|     |   |
|-----|---|
|     | <br>MAIN<br>CAMERA<br>RECIPE<br>SETTING<br>Sample<br>LED OFF<br>x10 |
| CCD | Screen showing CCD observed through camera tab                      |

## 5.1 Microscope

### 5.1.1 Components of microscope

Microscope is connected to CP-8000+ through USB cable.

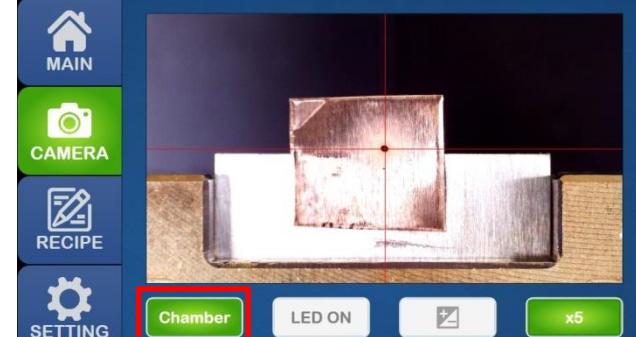
Components of microscope are as outlined below.

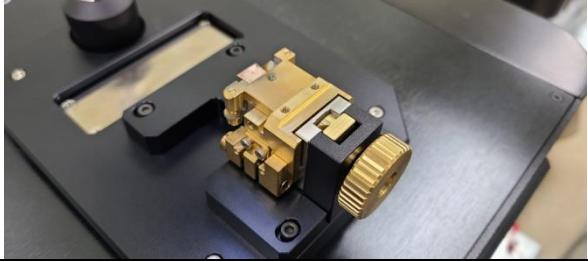
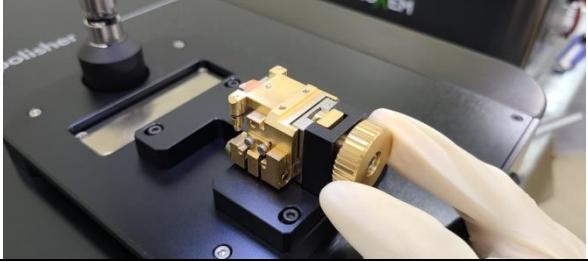
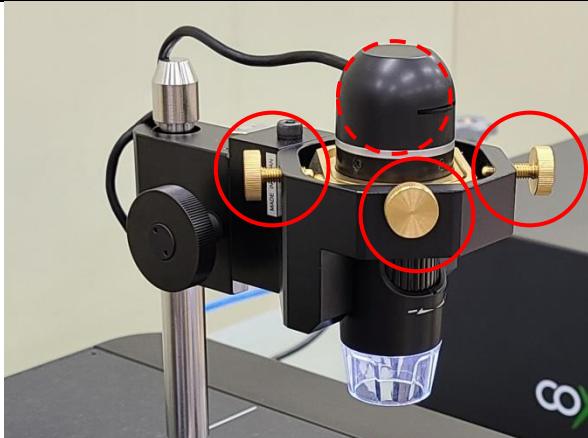
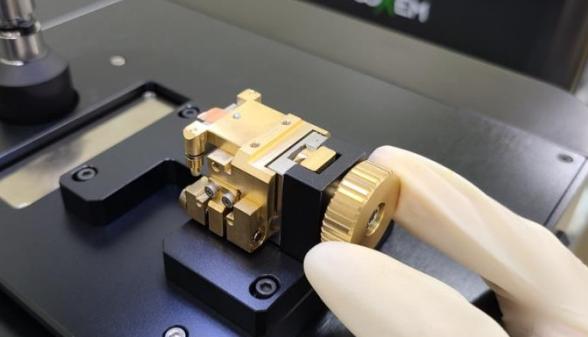


| No. | Name                      |
|-----|---------------------------|
| ①   | LED Brightness adjustment |
| ②   | Z-axis knob               |
| ③   | Control jig               |
| ④   | Sample stub holding jig   |
| ⑤   | Base bed(Optional)        |

### 5.1.2 How to use microscope

How to use microscope is as outlined below.

|   |  |
|---|--|
| <br>1) Touch CAMERA tab on CP-8000+. | <br>1-1) Convert to sample condition.<br>Chamber: CCD / Sample: camera |
|---|--|

|   |  |
|---|--|
|          |    |
| 2) Load holder adjusting to sample stub holding jig.                                      | 3) Turn sample stub holding jig fixing screw clockwise to fix holder.                |
|         |   |
| 4) Use control jig to adjust screen position.   | 5) Use LED Brightness adjustment to adjust screen brightness.                        |
|        |  |
| 6) Touch magnification button on CAMERA tab to change observation magnification. (X5~X40) | 7) Turn sample stub holding jig fixing screw counterclockwise to remove holder.      |

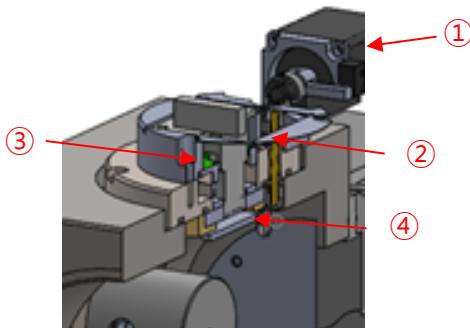


Use beam position and concentricity condition to maintain center of horizontal and vertical scale on microscope. Refer to [6.4 Ion Beam Align] for ION-BEAM ALIGN of microscope.

使用光束位置和同心度条件来保持显微镜上水平和垂直刻度的中心。

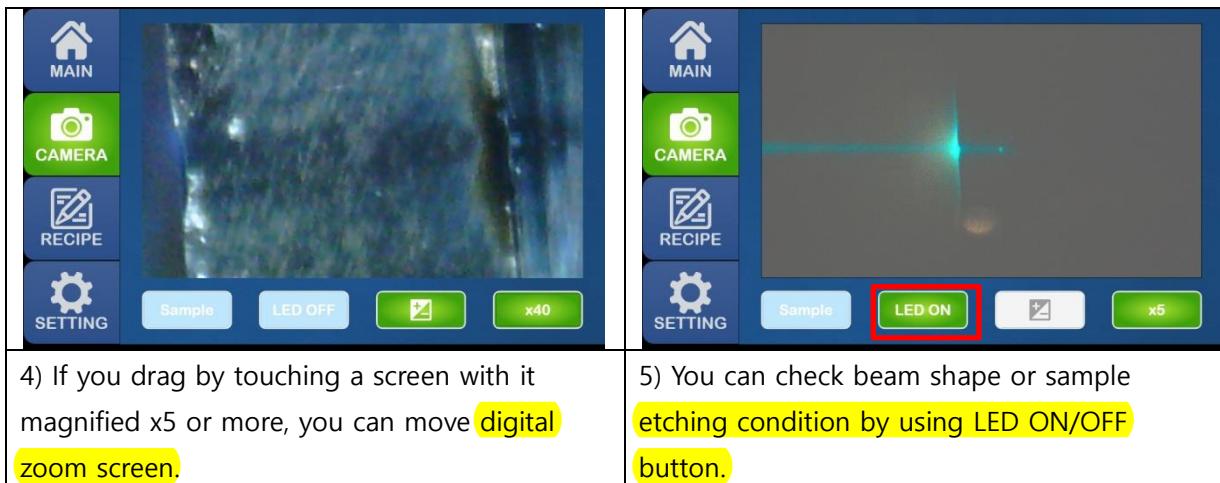
## 5.2 CCD

Chamber has embedded CCD.



| No. | Name                       |
|-----|----------------------------|
| 1   | CCD driving motor          |
| 2   | CCD electronic board       |
| 3   | CCD camera                 |
| 4   | CCD protective glass cover |

|  |   |
|--|---|
|  |   |
| <p>1) Touch CAMERA tab on CP-8000+.</p>  | <p>1-1) Convert to chamber condition.<br/>Chamber: CCD / Sample: camera</p> |
|  |   |
| <p>2) Press contrast control button to adjust brightness of a screen. (brightness control consists of 5 steps)</p> | <p>3) Touch magnification button to adjust magnification. (X5~X40)</p>      |



When operating CP-8000+, Re-deposition effect from etching occurs.  
(Re-deposition effect: phenomenon that etched particle contaminates the inside of chamber)

The inside of chamber gets contaminated gradually as product use is accumulated for a long time.

You need to clean CCD cover glass periodically.

Refer to [9.2 CCD Protective Glass Cover Cleaning] for detailed CCD cover glass cleaning.

## 6. Checking Ion Gun Condition

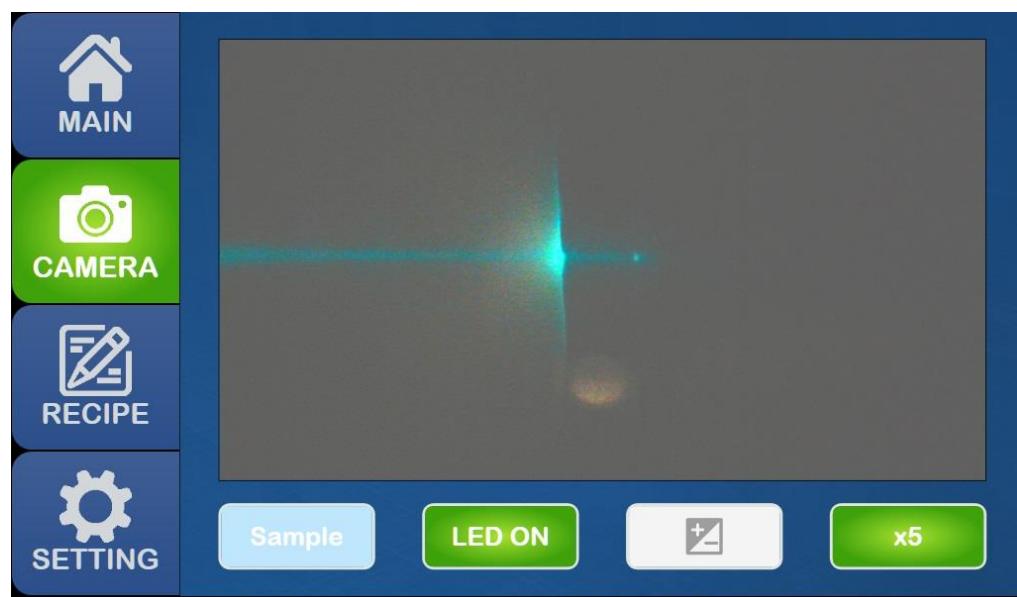
### 6.1 Overview

You need to inspect Ion-Gun condition before using CP-8000+.

Procedures for checking condition are classified into Beam Shape, Beam Current, Ion Beam Align, and Standard Etching Rate Check.

### 6.2 Beam Shape

Check beam shape with LED off by pressing CAMERA button and touching Chamber screen once Ion Beam focusing starts by pressing START button.



- Figure showing observation of ion beam through CAMERA-Chamber CCD(LED OFF) -

本产品设计用于通过腔室中的法拉第杯测量离子束的电流值。

### 6.3 Checking Beam Current

This product is designed to measure current value for ion beam through Faraday Cup in a chamber.

In case that proper beam current fails to be measured according to setting of acceleration voltage (in case that there is no Ar Gas, in case that ion gun cleaning is needed, in case that ion gun connection is poor), it is impossible to proceed with etching by Purge function any more.



Faraday Cup in a chamber



Refer to [8.5 Purge] for Purge function.

CP-8000+ 上的离子枪为固定式，设计用于始终将离子束辐射

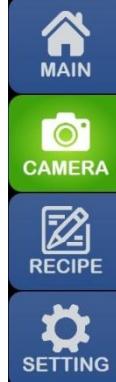
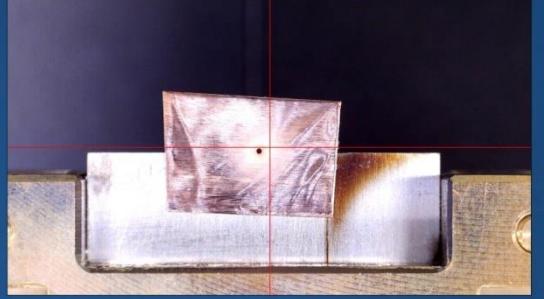
### 6.4 Ion Beam Align

到同一位置。

Ion Gun on CP-8000+ is fixed type and designed to radiate ion beam to the same position at all times. If you align graduated ruler on a microscope and edge of sample holder mask to a position which beam is radiated, etching side position can be located at the center of beam.

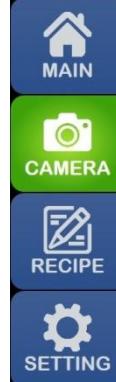
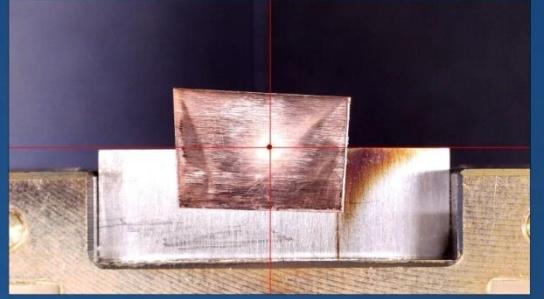
| - Cases that you need to perform Ion Beam Align - |  |
|---|--|
| 1   | When installing this product                             |
| 2   | When moving this product                                 |
| 3   | When cleaning and replacing Ion Gun                      |
| 4   | When position of microscope or mask is bent out of shape |

-Overview of Ion Beam Align Process -

|   |   |
|---|---|
|  | <br><span style="background-color: green; color: white; padding: 2px 10px; border-radius: 5px;">Chamber</span> <span style="background-color: white; border: 1px solid black; padding: 2px 10px; border-radius: 5px;">LED ON</span> <span style="background-color: white; border: 1px solid black; padding: 2px 10px; border-radius: 5px;">✖</span> <span style="background-color: green; color: white; padding: 2px 10px; border-radius: 5px;">x5</span> |
|---|---|

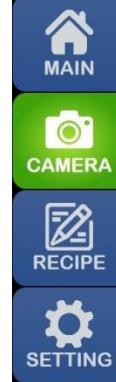
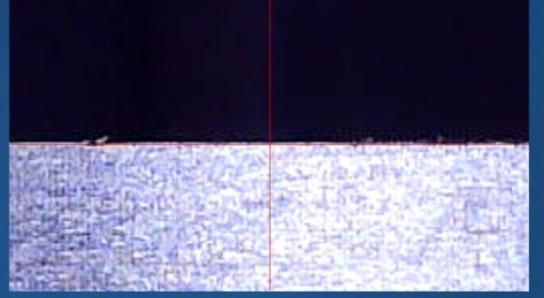
1) Checking beam position

- Position marked by attaching copper tape to stub and etching it becomes beam position.

|  |  |
|--|--|
|  | <br><span style="background-color: green; color: white; padding: 2px 10px; border-radius: 5px;">Chamber</span> <span style="background-color: white; border: 1px solid black; padding: 2px 10px; border-radius: 5px;">LED ON</span> <span style="background-color: white; border: 1px solid black; padding: 2px 10px; border-radius: 5px;">✖</span> <span style="background-color: green; color: white; padding: 2px 10px; border-radius: 5px;">x5</span> |
|--|--|

2) Align center of microscope lens to beam position

- Adjust microscope lens position so that beam position can be located at the center of microscope graduated ruler.

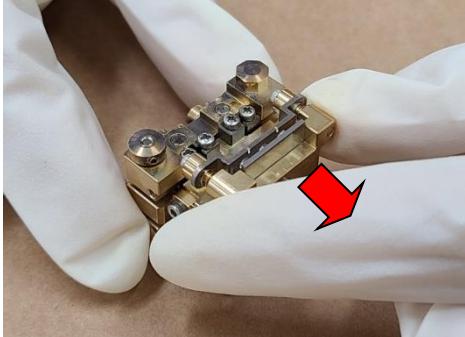
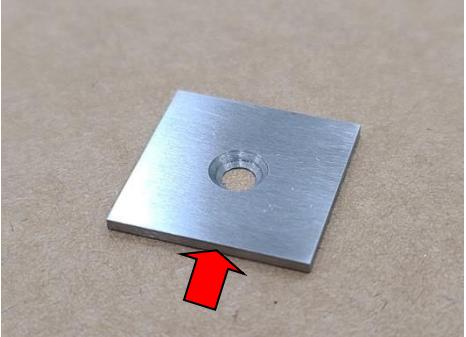
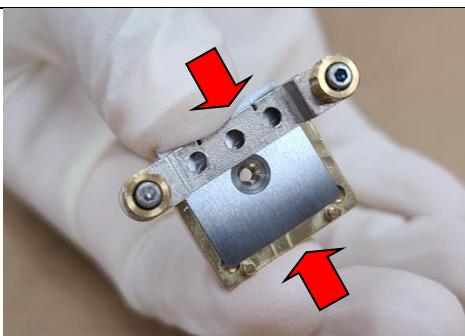
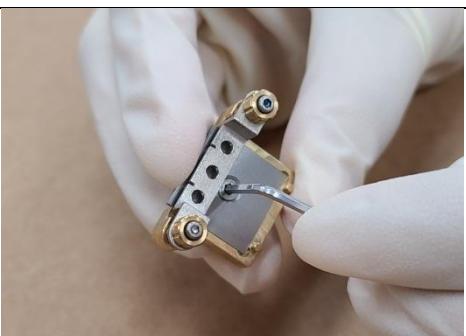
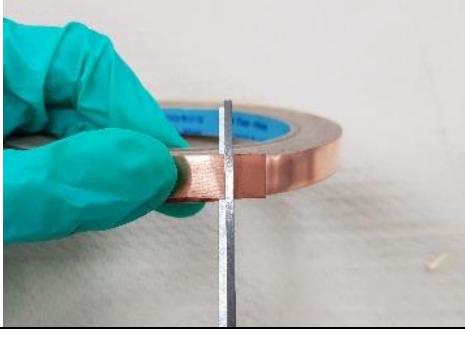
|   |  |
|---|--|
|  | <br><span style="background-color: green; color: white; padding: 2px 10px; border-radius: 5px;">Chamber</span> <span style="background-color: white; border: 1px solid black; padding: 2px 10px; border-radius: 5px;">LED ON</span> <span style="background-color: white; border: 1px solid black; padding: 2px 10px; border-radius: 5px;">✖</span> <span style="background-color: green; color: white; padding: 2px 10px; border-radius: 5px;">x40</span> |
|---|--|

3) Adjust mask edge to beam position

- Adjust mask height so that mask edge is on a level with microscope graduated ruler.

#### 6.4.1 Attaching copper tape and loading sample holder

Attach copper tape to grasp ion beam position.

|   |  |
|---|--|
|    |    |
| 1) Remove mask fixing jig on sample holder.   | 2) Check clean side position of a mask to be etched.                                 |
|   |   |
| 3) Insert in such a way that clean side of a mask can be placed at the top of mask fixing jig and press softly so that other side of a mask can be tight. | 4) Fasten mask fixing screw to connect to mask fixing jig.                           |
|    |  |
| 5) Cut reasonable amount of copper tape.  | 6) Attach copper tape to the front of sample mask on mask fixing jig                 |

|   |  |
|---|--|
|  |  |
| 7) Mount on sample holder based on guide at the bottom of mask fixing jig.        | 8) After VENT, open chamber door and load sample holder and then PUMP.             |

#### 6.4.2 Ion Beam Align Setup and etching

Store ion beam etching setting value as shown below while PUMP is underway.

|           |       |
|-----------|-------|
| HV        | 8kV   |
| Swing     | 0     |
| SET Time  | 00:10 |
| Auto Beam | 00/00 |

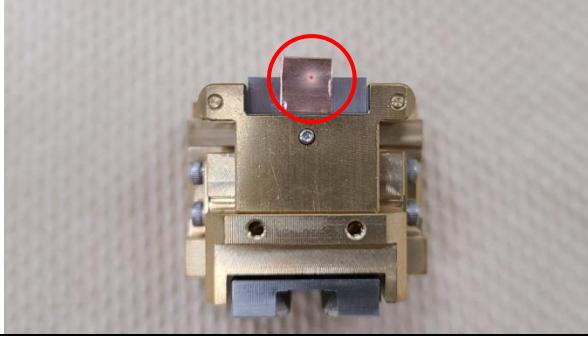
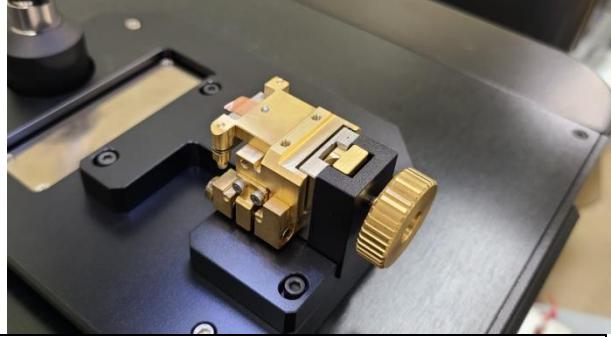
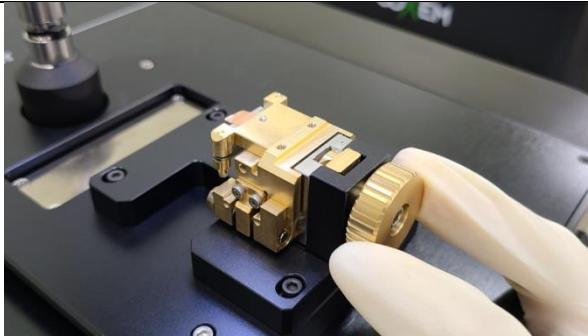
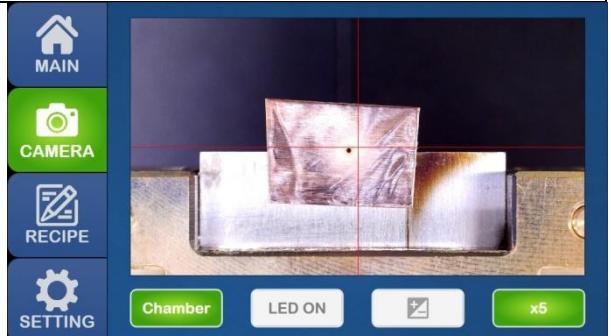
Refer to [4.1 setting control value] for detailed etching setup.

When proper degree of vacuum (Up to 8.0x10-6Torr) is reached after all setups are finished, press START button and wait until 10-minute etching ends.

### 6.4.3 Removing stub & loading microscope

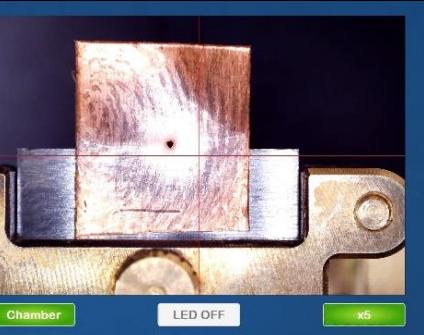
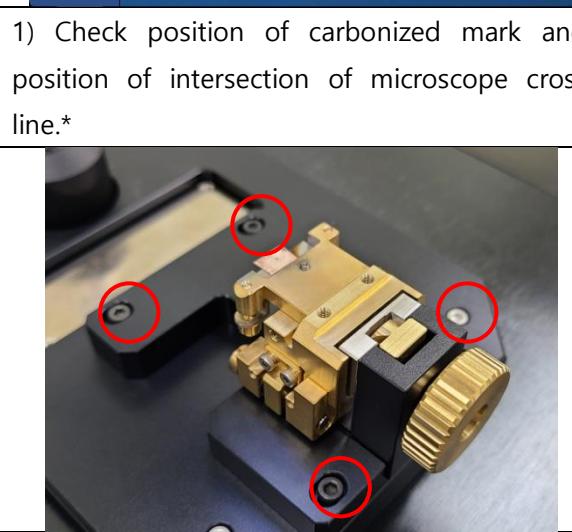
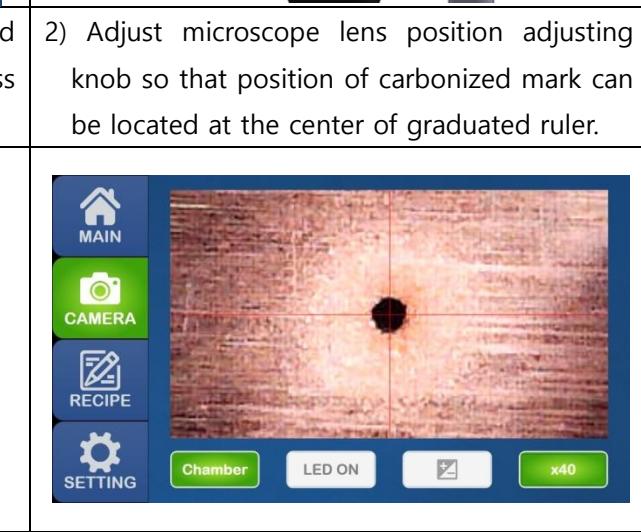
1) Remove stub after VENT when 10-minute etching on copper tape ends.

2) Load stub on microscope.

|   |   |
|---|---|
|                                |   |
| 1) Check carbonated position with naked eyes.<br>(In case that carbonated mark is not clear, try etching again) | 2) Load holder adjusting to microscope mount hole.                                  |
|                               |  |
| 3) Fasten holder fixing screw on microscope mount to fix holder.  | 4) Touch Chamber button on CAMERA tab for CP-8000+ to convert to microscope screen. |

#### 6.4.4 Ion Beam to Optical Microscope Align

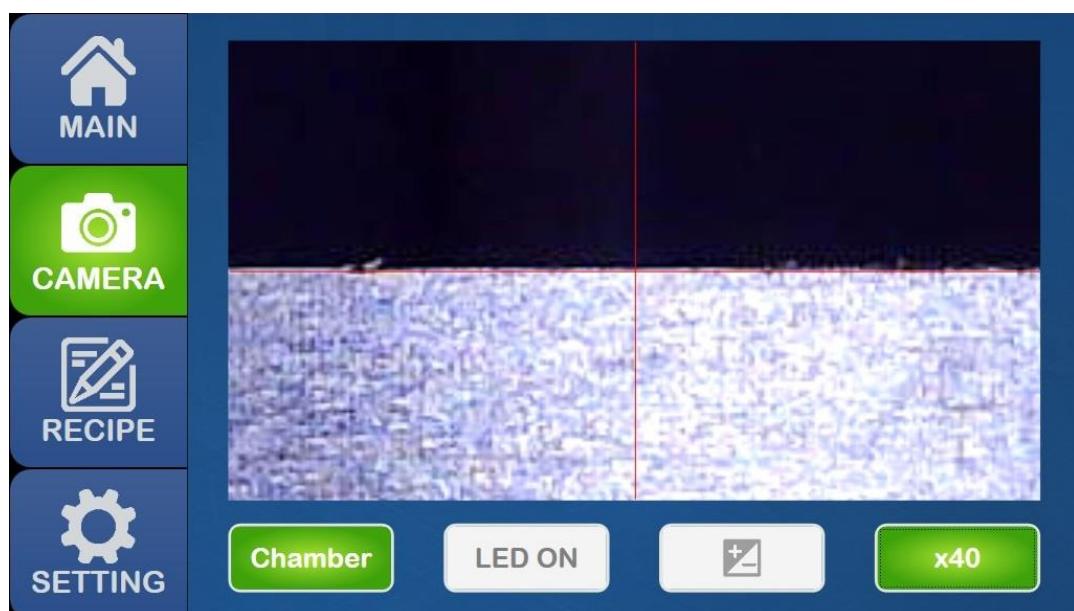
Align position of carbonized mark and position of intersection (center) of microscope graduated ruler.

|   |   |   |
|---|---|---|
|                    |    |   |
| <p>1) Check position of carbonized mark and position of intersection of microscope cross line.*</p> | <p>2) Adjust microscope lens position adjusting knob so that position of carbonized mark can be located at the center of graduated ruler.</p> |  |
| <p>2-1) In case that align is impossible in 2), adjust sample holder fixing jig position.</p>       | <p>3) Adjust microscope lens position adjusting knob so that position of carbonated mark can be located at the center of graduated ruler.</p> |   |

#### 6.4.5 Optical Microscope to Mask Align

Align microscope graduated ruler intersection (center) position and mask position.

|   |  |
|---|--|
|   |  |
| 1) Remove copper tape and check horizontal position of mask edge and graduated ruler. | 2) Adjust height adjusting screw so that mask edge can be located at the level of graduated ruler. |

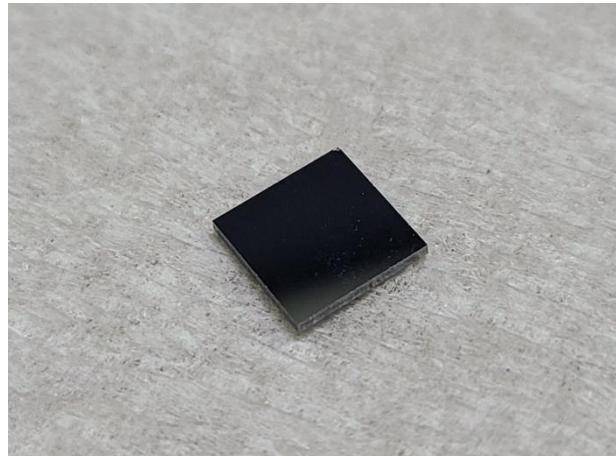


- Figure showing align is completed after height adjustment -

When all procedures are finished, perform whole process of [6.4 Ion Beam Align] again to check if align has been performed properly.

## 6.5 Checking standard etching rate

Use standard sample (Si Bare Wafer) to check standard etching rate.



- Standard sample: Si Bare Wafer -

|    |  |
|----|--|
| 1. | Quadrangle structure with width of 1cm x height of |
| 2. | Thickness should be 1mm or less                    |
| 3. | Bare condition with purity of Si 99% or higher     |
| 4. | Position to be etched should be free of pollution  |

- COXEM standard sample -

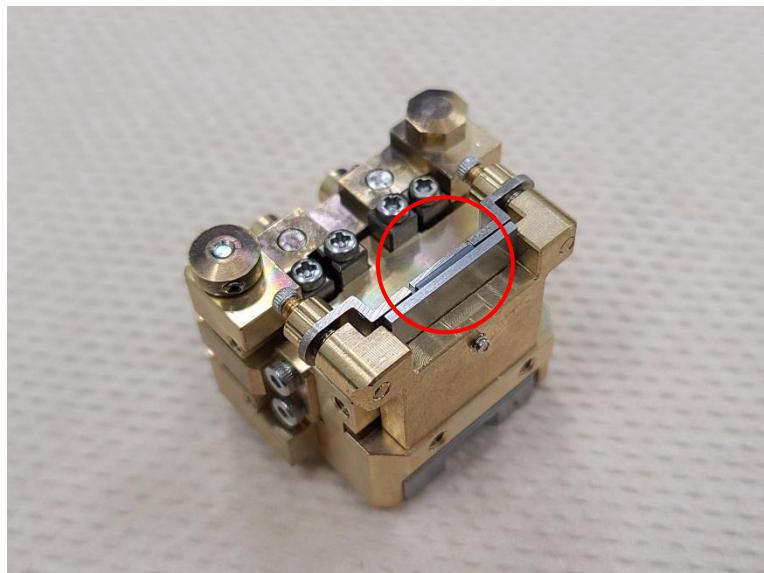


We do not guarantee etching rate for sample (material) other than standard sample provided by COXEM.

### 6.5.1 Preparing standard sample

Load Si Bare Wafer Sample onto sample holder.

样品架



- Refer to [7.4 sample holder loading] for procedures for sample loading.

### 6.5.2 Setting standard etching

Set etching as shown below to proceed with etching.

|           |       |
|-----------|-------|
| HV        | 8kV   |
| Swing     | 30    |
| SET Time  | 01:00 |
| Auto Beam | 00/00 |

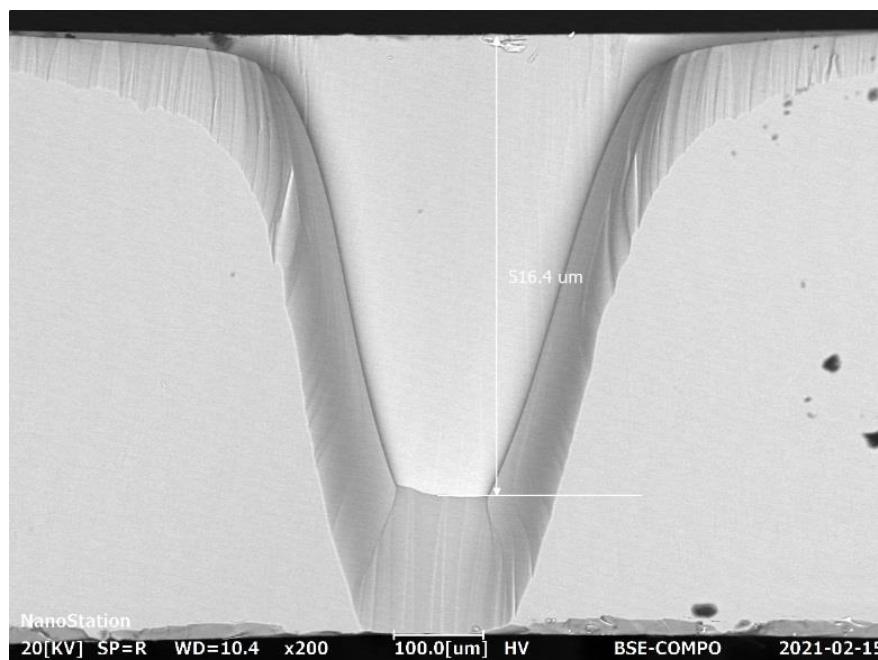
\* Refer to [4.1 setting control value] for how to set etching.

When proper degree of vacuum (Up to 8.0x10<sup>-6</sup>Torr) is reached after all setup is finished, press START button and wait until one-hour etching ends.

### 6.5.3 Checking etching rate after etching

After finishing etching, check etching rate for sample.

Based on standard sample (Si Bare Wafer), etching rate is 500um/h or more.



Electronic microscope image (x200 magnification)

\* In case that etching rate does not reach standard, refer to [10.1 case that you fail to achieve etching rate].

## 7 Sequence of operation

### 7.1 Power ON

Apply power to CP-8000+ main body.

- Refer to [3.1 power ON] for how to supply power.



- It takes up to about 15 minutes until it reaches vacuum condition based on condition without sample and sample holder.  
(Time that takes to reach 100% vacuum may vary depending on product operation condition or types of sample.)

### 7.2 Preparing sample pretreatment

Among CP-8000+ operation procedures, sample preparation is the most important procedure which affects product performance and etching quality.

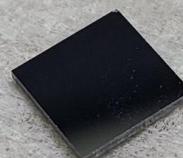
If you proceed with etching for a long time with sample fixed poorly, it may lead to meaningless result.

Let's find out methods and cautions through sample preparation procedure.

截面抛光

Before using Cross-section Polisher, prepare components.

| Model       | Image  | Note     |
|-------------|--|----------|
| Copper Tape |  | Qty: 1EA |
| Carbon Tape |  | Qty: 1EA |

|                                 |   |                     |
|---------------------------------|---|---------------------|
| Scissor                         |    | Qty: 1EA            |
| Tweezers                        |    | Qty: 1EA            |
| Wrench Set<br>(7 PCS)           |    | Qty: 1EA            |
| Si Wafer Piece                  |  | Qty: 1SET<br>(10EA) |
| Blower                          |  | Qty: 1EA            |
| Sand Paper<br>(400, 1000, 2000) |  | Qty: Each 5EA       |
| Pical                           |  | Qty: 1EA            |

|                   |  |          |
|-------------------|--|----------|
| Ion Gun Jig       |  A circular, metallic ion gun jig with a central hole and a flared base, resting on a brown textured surface.                                | Qty: 1EA |
| SEM sample holder |  A rectangular, metallic SEM sample holder with a central vertical slot and two mounting holes, resting on a light-colored textured surface. | Qty: 1EA |



- CAUTION**
- You must wear sanitary gloves before handling samples.  
If you handle samples with empty hands without wearing gloves, it may cause product performance to be deteriorated due to pollutants.
  - Make sure to wear protective glasses before preparing samples with glass, semiconductor etc.
  - Make sure to wear a mask before handling powder type sample.

## 7.3 Sample pretreatment

When sample has square · rectangular structure, the most ideal sampling is possible considering CP-8000+ stub structure.

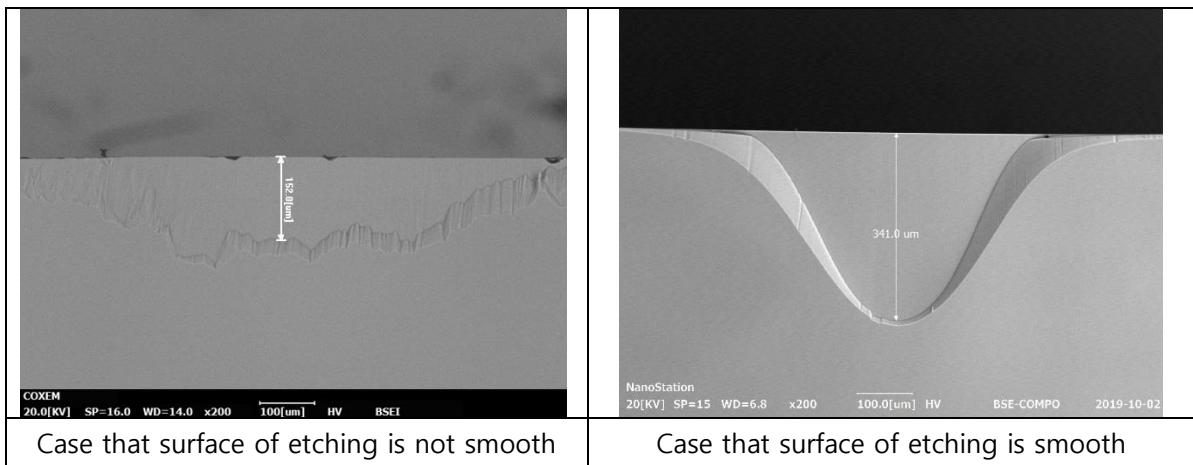
If surface of sample is curved, you can't get good etching result due to poor stub attachment.

Let's find out sample pretreatment process.

### 7.3.1 Wafer Sample

Wafer Sample is easy for pretreatment because both sides have flat shape which makes it easy to compress with mask side.

The better roughness of etching side on wafer, the better etching result you can get.



### 7.3.2 Molding Sample

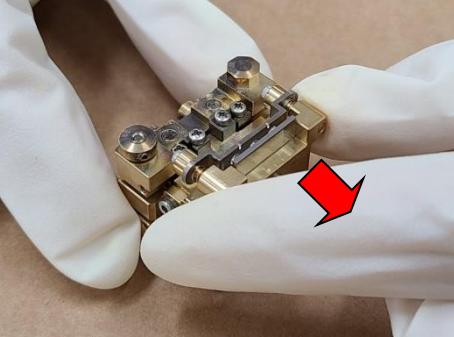
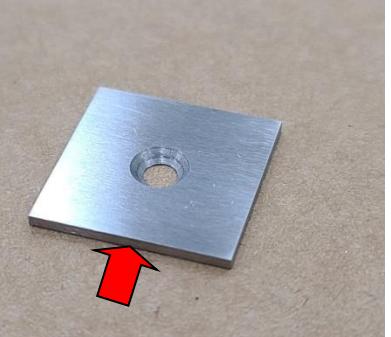
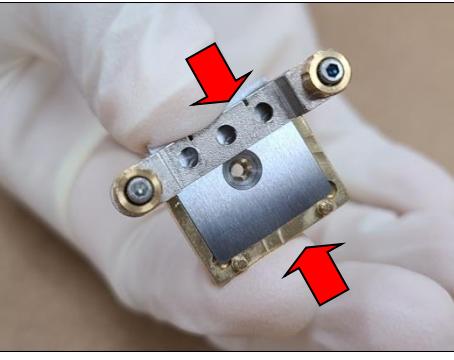
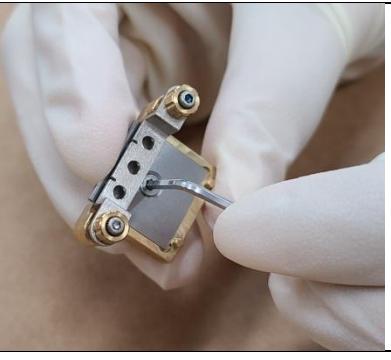
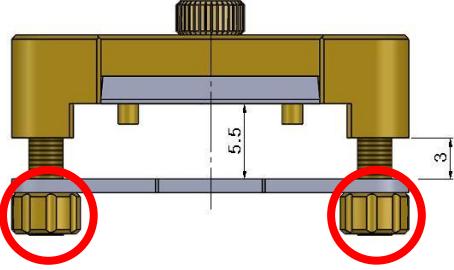
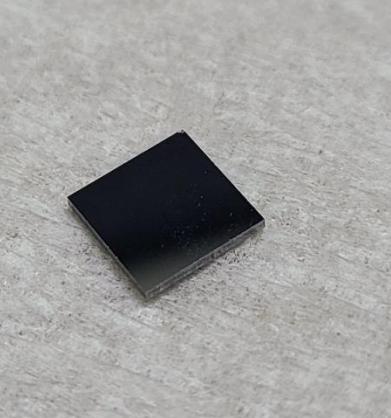
Sample with small particles such as powder is difficult to be attached to stub.

Let's find out how to make sample using molding technique. 成型技术

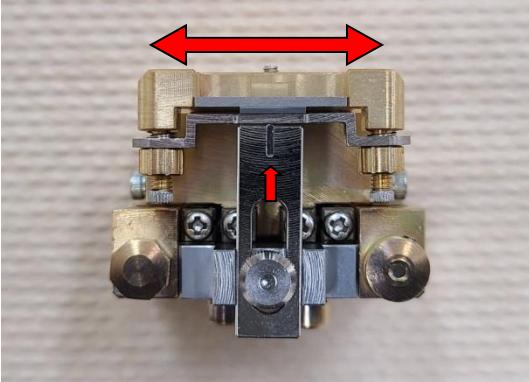
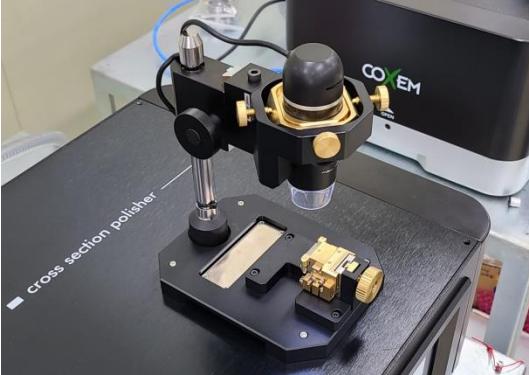
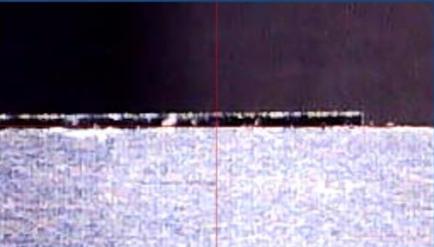
|  |   |
|--|---|
|   |   |
| <p>1. Prepare sample, Resin, Hardner, Slide Glass etc.</p>   | <p>2. Mix Resin and Hardner in the ratio of 10:1 and then mix it with sample to make it quadrangle shape.</p>                 |
|    |    |
| <p>3. If you put sample mixture into ion coating machine and hold vacuum for about 10 to 20 seconds, gas in sample mixture gets out.</p> | <p>4. Start first hardening so that sample can be made flat by compressing molding sample with slide glass in four sides.</p> |
|   |   |
| <p>5. Use Heating Plate to make sample quadrangle shape as much as possible.<br/>(Proceed until sample mixture is hardened)</p>          | <p>6. When molding is finished, treat surface roughness smoothly by using Sand Paper.</p>                                     |

## 7.4 Loading sample holder

Load sample which pretreatment has been completed onto sample holder.

|  |   |
|--|---|
|   |           |
| 1. Remove mask fixing jig on sample holder.  | 2. Check clean side position on a mask to be etched. (use side with good surface roughness) |
|    |          |
| 3. Insert in such a way that clean side of a mask is placed at the top of mask fixing jig and press it softly so that other side of a mask can be tight. | 4. Fasten mask fixing screw to connect mask fixing jig to a mask.                           |
|   |         |
| 5. Unfasten tension plate fixing screw to secure width that allows sample to be loaded.  | 6. Prepare sample.  |

|   |  |
|---|--|
|   |  |
| <p>7. Insert sample between tension plate and mask. (pretreat sides of sample to be etched so that they can be flat.)</p>               | <p>8. Mount height adjusting jig (select among 30um, 50um, 80um) onto mask fixing jig.</p> |
|   |  |
| <p>9. Push the bottom of sample and attach it to height adjusting jig so that it is horizontal.</p>                                     | <p>10. Fasten tension plate fixing screw (2EA) to fix sample.</p>                          |
|   |  |
| <p>11. Bend height adjusting jig backwards in the opposite direction. (be careful about handling to avoid change in sample height.)</p> | <p>12. Mount mask fixing jig onto sample holder.</p>                                       |

|   |  |
|---|--|
|                          |    |
| 13. Mount beam position jig and slide mask fixing jig position from side to side to set etching position. | 14. Remove beam position jig.  |
|                         | <br>MAIN<br>CAMERA<br>RECIPE<br>SETTING<br>Chamber LED ON + X40 |
| 15. Load sample holder onto microscope.   | 16. Check sample height through microscope.  |

## 7.5 Mounting sample holder

### 7.5.1 Sample holder A (WD: 13.1mm)

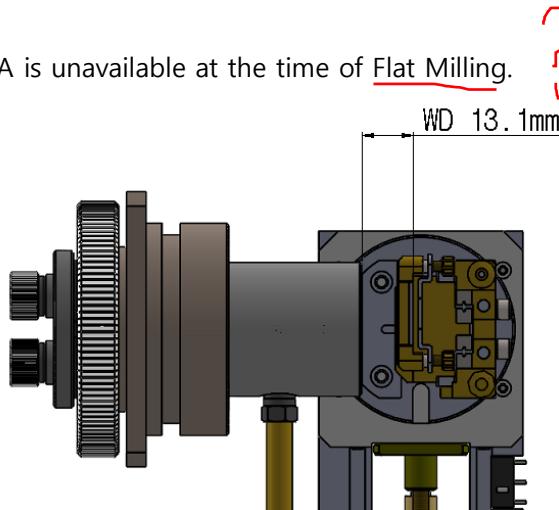
How to use sample holder may differ depending on **milling mode**.

In case that sample holder A is applied, distance between edge of ion gun beam emittance and sample is set to 13.1mm. As beam distance is shortened and swing angle enlarges, etching depth is reduced but etching width increases. Sample holder A is used if you want to get great width at the time of Normal Mode etching.

Sample holder A is vulnerable to ion gun pollution from particles that occur during etching because distance between sample and ion gun is close. You need to clean sample holder A periodically.

- Sample holder A is unavailable at the time of Flat Milling.

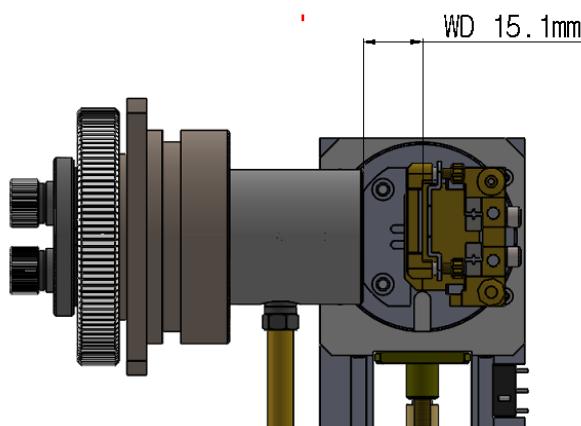
样品架A 只能用于横截面抛光

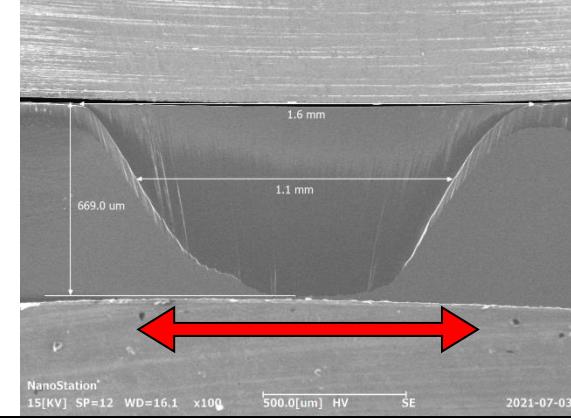
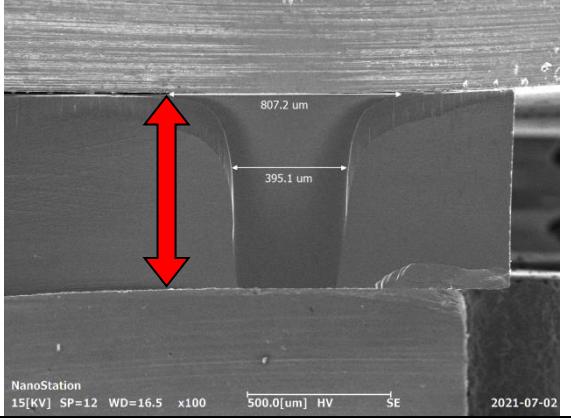


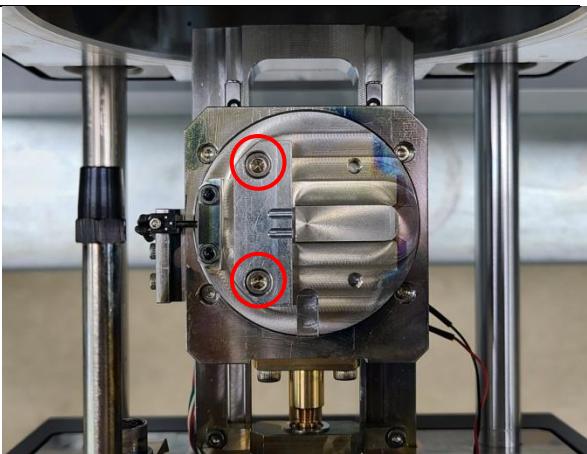
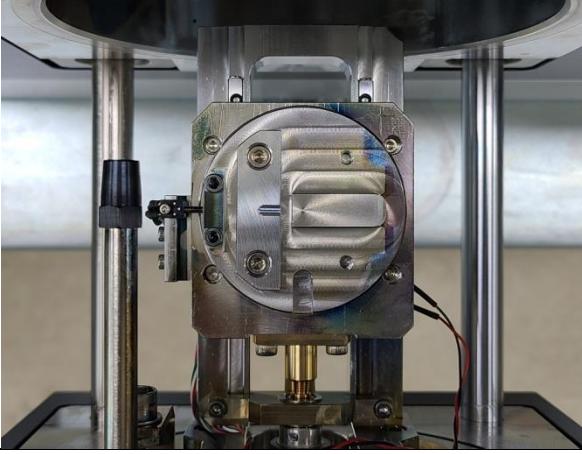
### 7.5.2 Sample holder B (WD: 15.1mm)

In case that sample holder B is applied, distance between edge of ion gun beam emittance and sample is set to 15.1mm. As beam distance lengthen, swing angle reduces, etching width is short but etching depth increases. Sample holder B is used when you want to get great etching depth.

- Sample holder B is for Flat Milling.



|  |   |
|--|---|
|   |   |
| <p>Increase etching width by applying Normal Milling Mode Sample Holder A</p> <p>( TEST Condition: 8kV / 1hr / ±30° / Si Wafer )</p> | <p>Increase etching depth by applying Normal Milling Mode Sample Holder <u>B</u></p> <p>( TEST Condition: 8kV / 1hr / ±30° / Si Wafer )</p> |

|   |   |
|---|---|
|   |                      |
| <p>1) Touch VENT button and when degree of vacuum in a chamber becomes atmospheric pressure condition, open chamber door.</p> | <p>2) Unfasten sample fixing plate B screw mounted on stage to remove sample holder fixing plate B.</p> |
|    |                     |

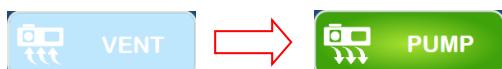
|   |  |
|---|--|
| 3) Mount sample holder fixing plate A and fasten screw. | 4) Close chamber door and PUMP to convert to vacuum condition. |
|---|--|

## 7.6 Mounting sample holder

When sample preparation is finished, mount sample holder onto stage.

1) Touch [VENT] button on equipment display to release vacuum condition.

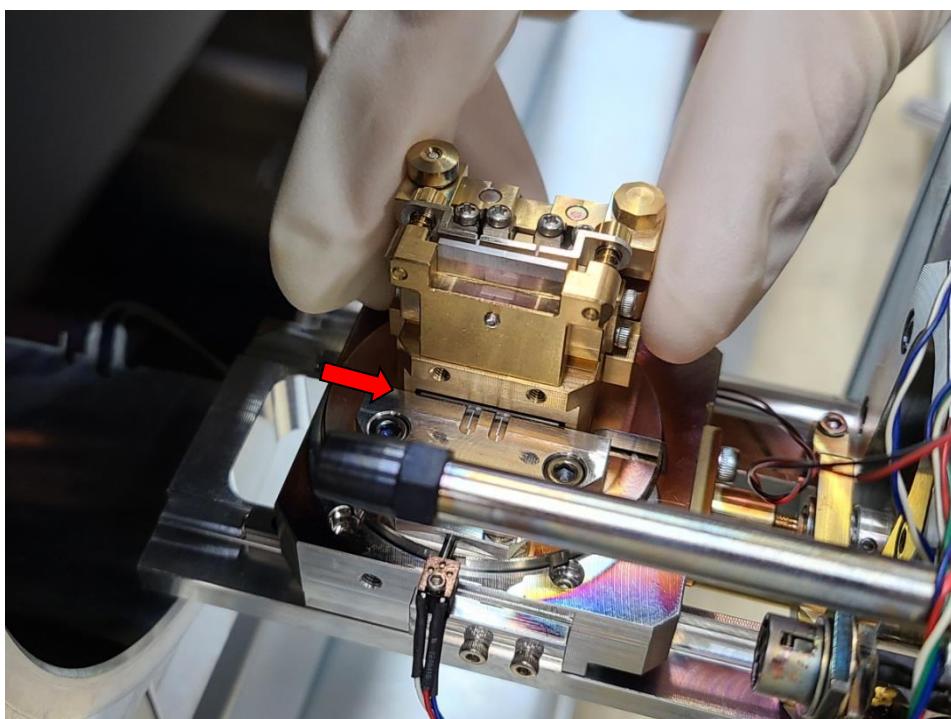
(This causes degree of vacuum in a chamber to convert to atmospheric condition and it takes about 4 minutes.)



2) Open chamber door to mount sample holder adjusting to stage hole.

(Attached by magnetism on sample holder fixing plate.)

Check if objects are attached closely.



3) Push chamber door to the end to close it.



4) If you touch  button after closing chamber, it converts to vacuum condition.

---



- Be careful that alien substance does not enter chamber while loading sample.
  - Be careful that cable does not put into chamber while closing chamber door.
-

## 7.7 Setting recipe and starting etching

Predetermined etching value can be used diversely depending on characteristics of sample and degree of etching.

Recipe can store various predetermined etching values with up to eight conditions and etch with the same condition at any time through importing.

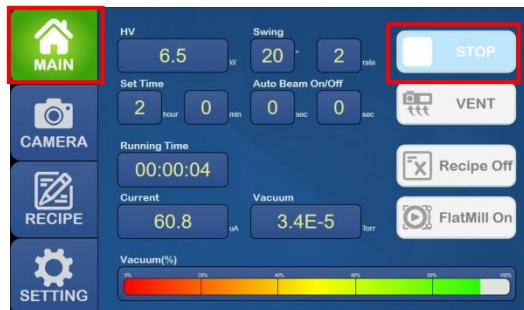
Let's find out how to set Recipe and how to START etching.

### 7.7.1 START as new set value

- 1) Touch SETTING tab and set predetermined value and touch  button.



- 2) Check if set value is right by touching Main button and touch  button to start etching.



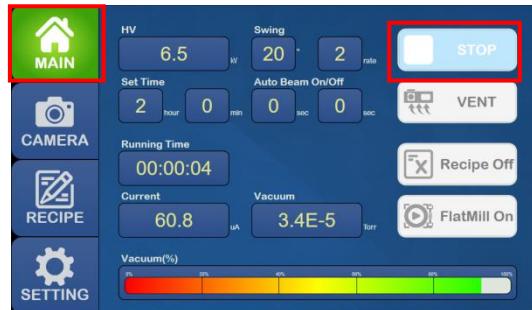
### 7.7.2 START as existing recipe

- 1) Touch Recipe tab and select recipe you want and then touch

**Apply** button.



- 2) Check imported recipe is right by touching Main button and touch **START** button to start etching.

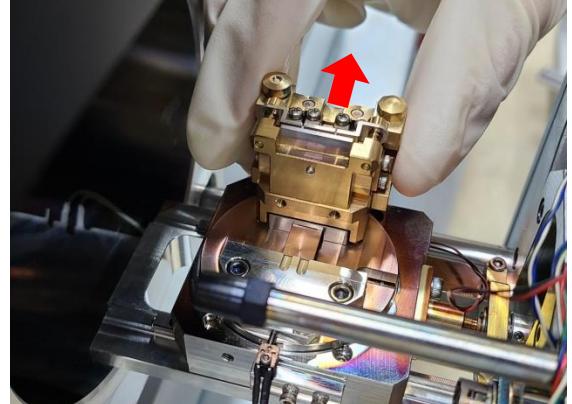


Refer to [4. UI operation] for how to use control value.

## 7.8 Ending etching and removing sample

If STOP button changes to START button, it means that all etching procedures are ended.

If etching ends, ion beam turns off and stage returns to home position.

|  |  |
|--|--|
|   |    |
| 1) Touch VENT button.  | 2) Open chamber door and remove sample holder.                                       |
|  |  |
| 3) Close chamber door and push it softly.  | 4) Touch PUMP button to change to vacuum condition.                                  |

\* If there is no operation for 5 minutes after etching ends, product enters sleeping mode.



In case of sleeping mode, rotary pump power and turbo pump power shut off and thus if you want to release sleeping mode, touch VENT button and then touch PUMP button again.

\* You may turn off power while sample holder is loaded into a chamber but we recommend that you should keep this product with chamber empty if possible.

## 7.9 Power OFF

We recommend that you should keep CP-8000+ chamber clean and maintain vacuum through power supply as this product is vacuum one.

If you intend to not to use this product for a long period, turn off power to this product as outlined below.

- 1) Check if button is START button. (In case that button is STOP button, convert to START button.)



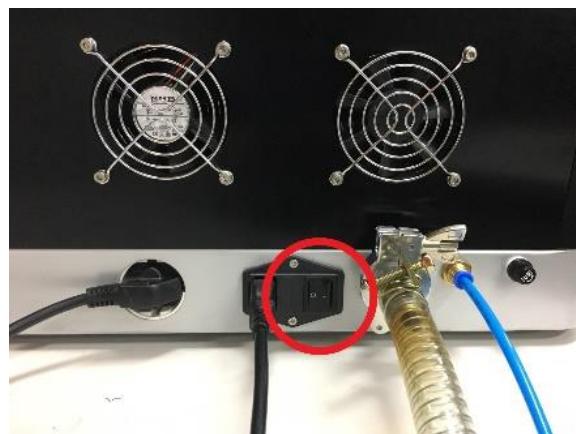
- 2) Keep high vacuum condition of 8.0xE-6 Torr or higher.



- 3) Press power switch located at the side of CP-8000+ long to turn off power.



- 4) Turn off main power switch at the back of CP-8000+.



\* Make sure to turn off power for this product while this product is in vacuum condition.  
(Make sure to turn off power while this product is in vacuum condition of 8.0xE-6 Torr or more)

\* Even if you do not use this product for a long period, you need to supply power to this product periodically so that this product can keep vacuum condition.

---

## 8 Functions

Let's find out useful functions of this product other than etching functions.

| Chapter | Name              |
|---------|-------------------|
| 8.1     | STEP BY STEP MODE |
| 8.2     | Auto Beam On/Off  |
| 8.3     | Flat milling      |
| 8.4     | Swing Mode        |
| 8.5     | Purge             |

## 8.1 STEP BY STEP MODE

You can proceed with etching in consecutive order by storing various recipes.

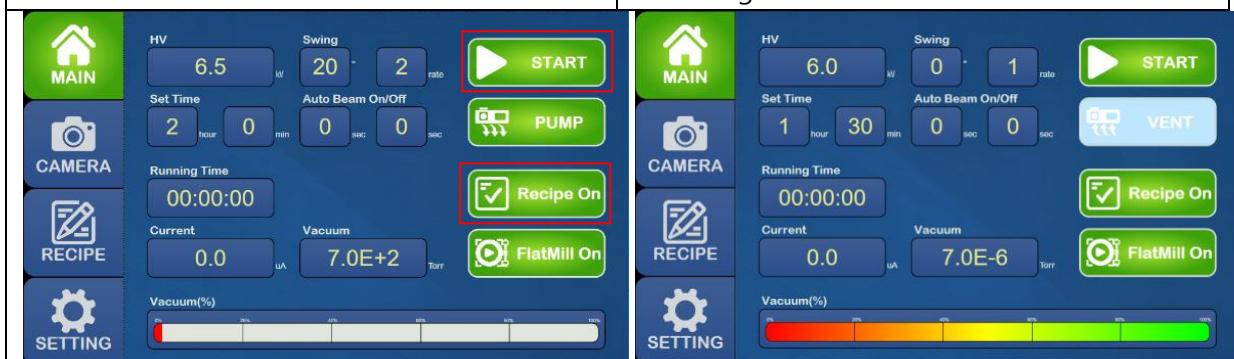
This mode is used when post treatment in addition to basic etching is needed.

-You can proceed with STEP BY STEP function in a state of BASE PRESSURE after loading a sample.



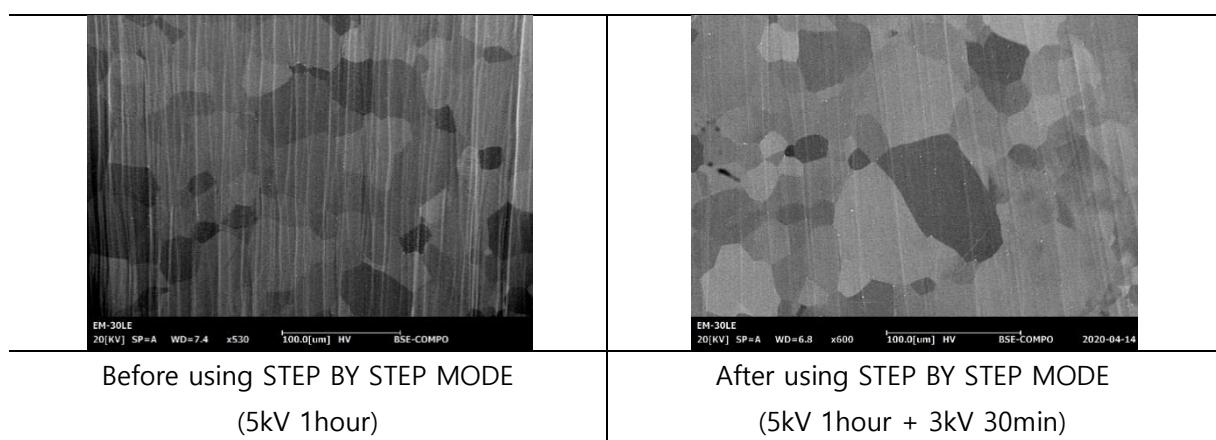
1) Enter set value at SETTING tab and touch SAVE button to set.

2) After entering RECIPE tab, arrange sequence of etching.



3) After entering MAIN tab, touch Recipe On button to start.

4) When all etching ends as ordered in RECIPE, vent and then remove a sample.

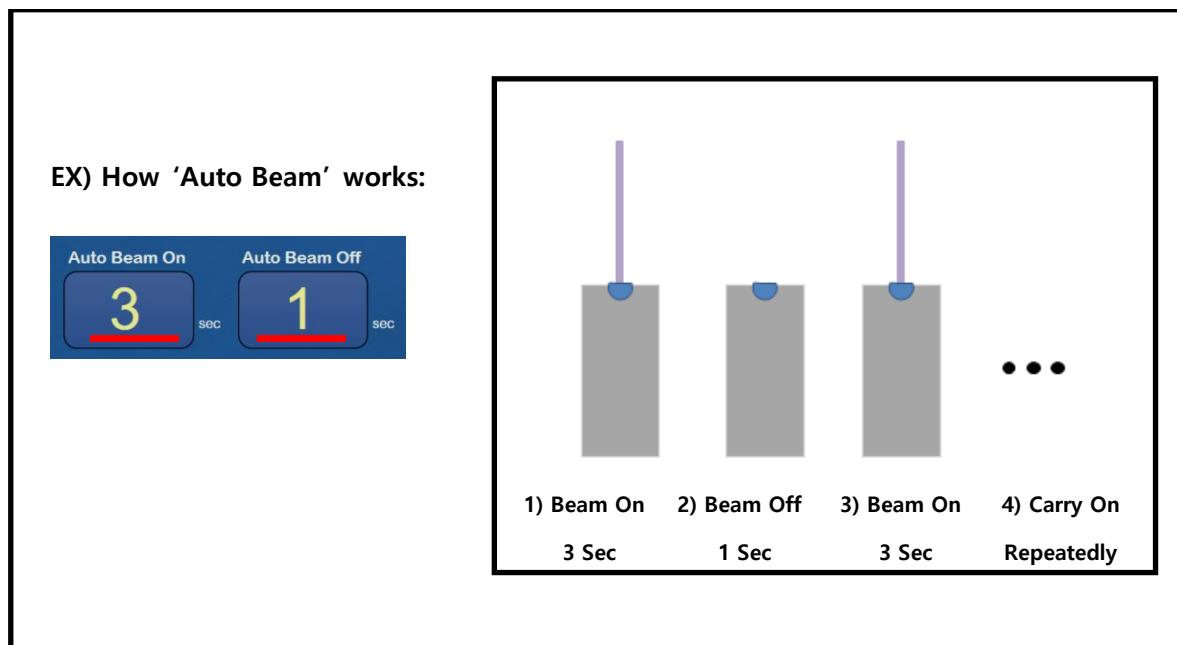


- Images showing use of STEP BY STEP MODE -

## 8.2 Auto Beam On/Off

This function can minimize sample damage by repeating turning on and off beam according to predetermined Ion Beam ON/OFF timer.

In case that you start etching with auto beam set as '03/01' as shown below, you are advised to turn on beam for three seconds and turn off it for one second and repeat it.



---

\* We recommend that you use this function when observing a sample which is vulnerable to laceration from ion beam.



\* Because Beam On-Off is repeated, it is likely that etching rate is poorer than etching time.

---

## 8.3 Flat Milling

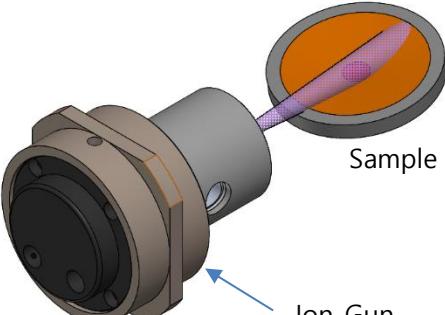
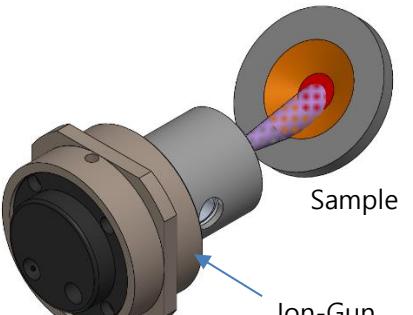
This function is to etch surface of sample by injecting ion beam into flat surface of sample using sample holder for flat milling other than single phase etching of general sample.

Be careful that depth of etching rate is low suiting etching purpose.

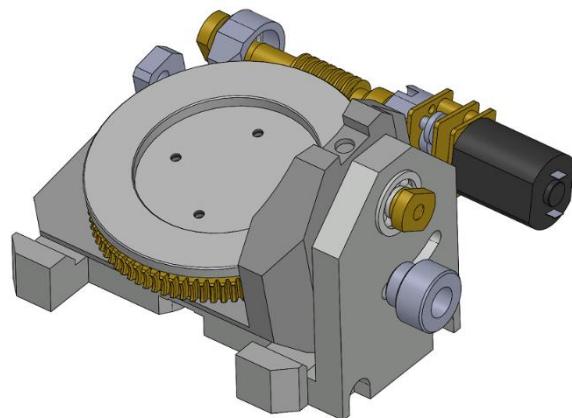
### 8.3.1 Overview of Flat Milling

Flat milling allows you to observe clean surface of a sample by removing oxidized layer on the surface of a sample or property of interface of a sample without cutting a sample physically.

Flat milling allows you to observe a wide area by etching wider area than cross section.

| - Etching area that varies according to Flat Milling Holder Angle |  |   |
|---|--|---|
| Image   |  |  |
| Holder Angle  | When it is low   | When it is high   |
| Characteristics   | Etching area is wide but etching depth is shallow                                  | Etching area is narrow but etching depth is great                                   |

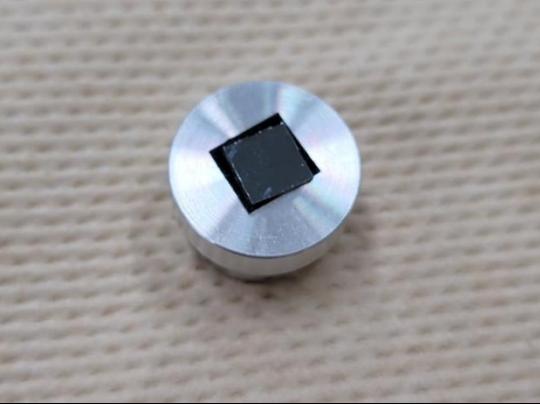
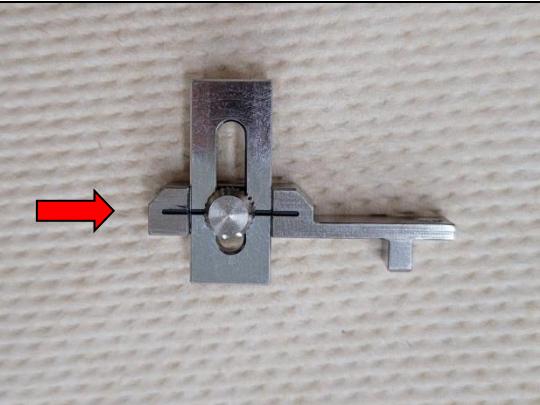
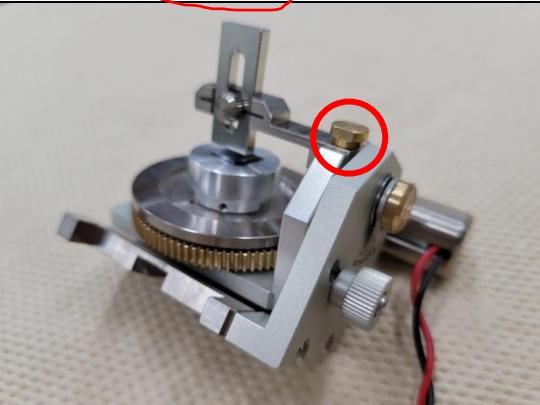
### 8.3.2 Flat Milling Process – Preparing samples

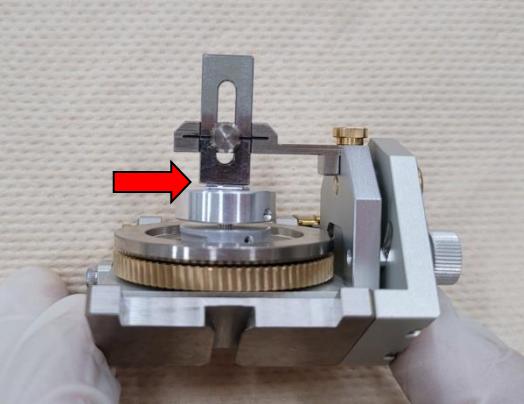
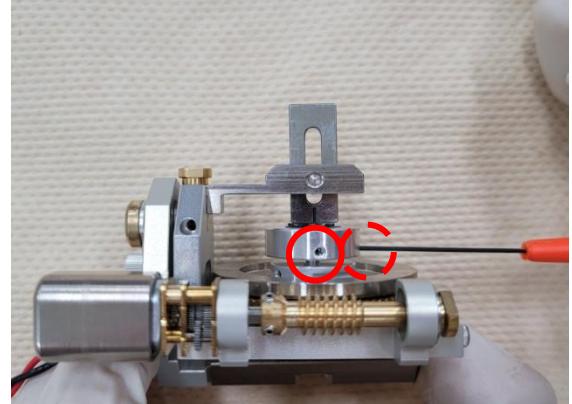


- Flat Milling Holder

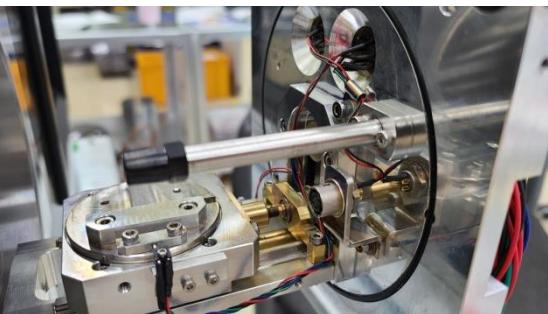
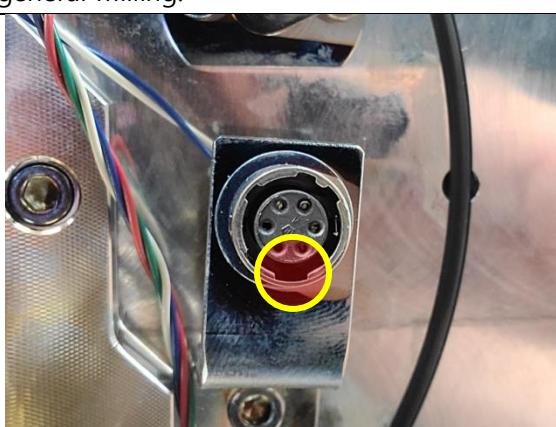
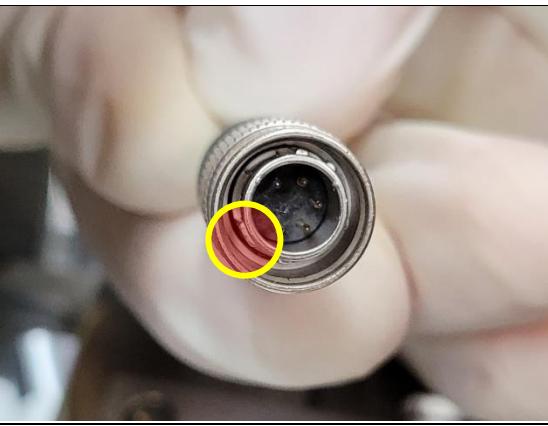
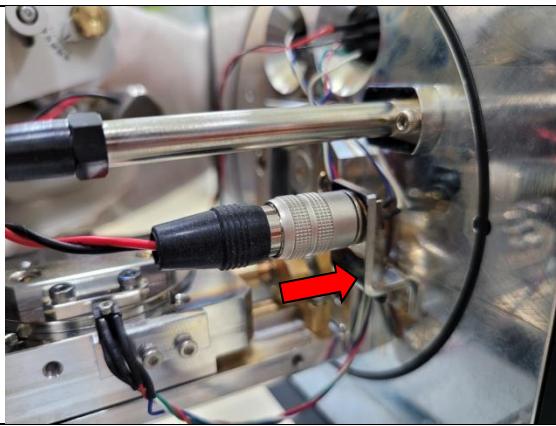
#### Basic information on Flat Milling

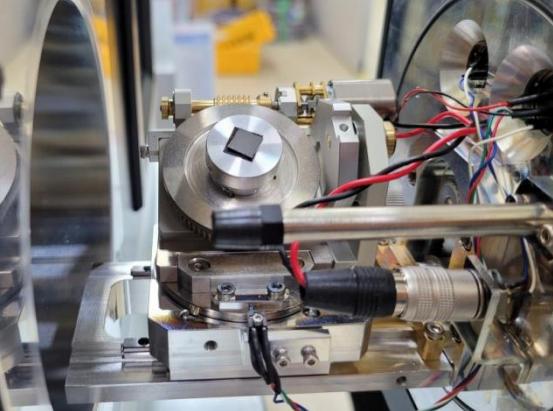
|                           |                      |
|---------------------------|----------------------|
| Scope of angle adjustment | 40~80°               |
| Working distance          | 11.4mm               |
| Etching Rate              | 2um/h (8kV, Al, 70°) |
| Maximum Milling Area      | >25mm                |

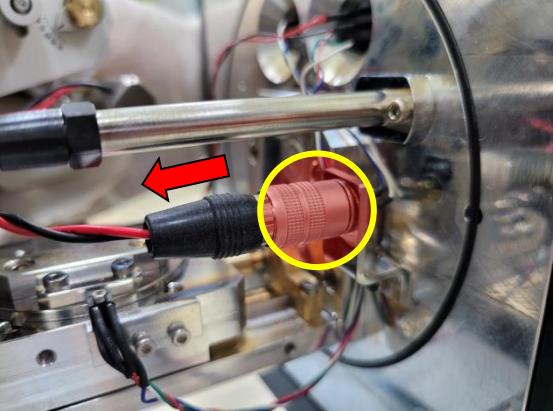
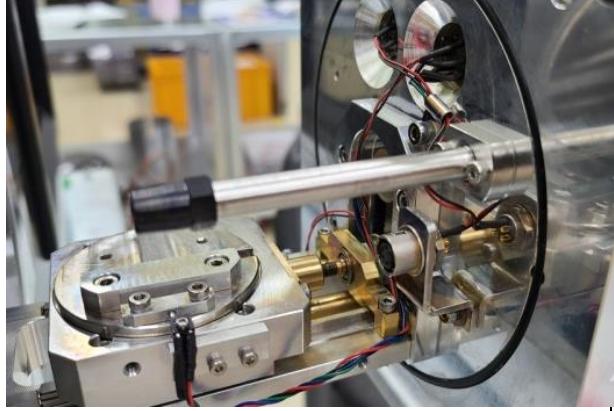
|   |  |
|---|--|
|                      |    |
| 1) Connect sample fixing plate and sample attaching plate each other.                                 | 2) Attach carbon tape to Flat Milling sample attaching plate.                        |
|                     |   |
| 3) Attach in such a way that sample surface faces upward carbon tape.                                 | 4) Put sample fixing plate on the center of flat stage. (attach by magnetism) 通过磁力吸附 |
|                    |  |
| 5) Adjust black base line position on beam center position determining jig and a sight and fix a nut. | 6) Insert flat stage beam position jig and fix with beam position jig nut.           |

|  |  |
|--|--|
|   |              |
| <p>7) Adjust sample attaching plate height in such a way that sample surface height contact flat stage beam position jig.<br/>(Be careful that sample height does not exceed a sight.)</p> | <p>8) Lock 2EA headless bolts at the side of sample attaching plate to fix height.</p>         |
|    |             |
| <p>9) Remove beam position jig.</p>  | <p>10) Set tilt angle at the side of flat milling sample holder. (available scope: 40~80°)</p> |

### 8.3.2 Flat Milling Process –Loading samples and Flat Milling

|   |  |
|---|--|
|    |    |
| 1) Vent CP-8000+ and open chamber door.   | 2) Remove sample holder fixing plate A for general milling.                          |
|   |   |
| 3) Mount sample holder fixing plate B for Flat Milling.                             | 4) Check wide pin position on connector terminal in chamber door.                    |
|  |  |
| 5) Check wide pin position on flat milling sample holder cable connector.           | 6) Insert connector based on wide pin position.                                      |

|  |  |
|--|--|
|                                   |    |
| <p>7) Mount Flat Milling Holder on stage.</p>  | <p>8) Touch SETTING tab to put etching conditions into each item and touch SET button.<br/>(Even if you enter swing value, it does not apply.)</p> |
|                                  |   |
| <p>9) Touch Flat Milling On button on Home tab to convert to Flat Milling Mode.<br/>(Check if holder rotates.)</p> | <p>10) Touch PUMP button to convert to vacuum condition.</p>   |
|                                 |    |
| <p>11) When degree of vacuum is reached, touch START button to proceed with etching.</p>                           | <p>12) When finishing etching, touch Flat Milling Off button to vent.</p>  |

|  |   |
|--|---|
|   |   |
| 13) Pull connector handle in horizontal direction to release connection.           | 14) Remove Flat Milling Holder from stage.  |
|  |  |
| 15) Close chamber door.  | 16) Touch PUMP button to convert to vacuum condition.                               |



\*At the time of Flat Milling, rotation speed is about 1RPM.

\* When using Flat Milling, make sure to use sample holder fixing plate.

## 8.4 Swing Mode

CP-8000+ provides swing function.

Proper swing value can minimize artifact such as curtain effect that can occur during etching.

You can check swing angle in big figure in swing display column on main screen.

Once etching starts, based on 0° ion beam front on sample holder, it rotates up to ±35° from side to side and it repeats until etching ends.

(In case that swing value is set to ±10°, based on regular position, move 10° to the left and 10° to the right and it repeats.)

Adjusting swing torque

Swing torque value is marked in small figure in swing display column on main screen.

Rotation speed of motor according to swing torque value is as outlined below.

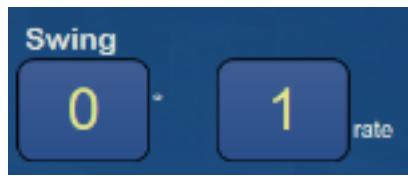


Table showing comparison of swing rate torque

| Swing Rate | RPM |
|------------|-----|
| 1          | 0.5 |
| 2          | 0.7 |
| 3          | 1.0 |
| 4          | 1.4 |

Apply proper torque value according to property of etching material and etching area.

## 8.5 Purge 系统性能, 真空度, 氩气, 离子束电流

Purge is to check performance of ion beam automatically during operation after etching start.

If a user touches START button in Base Pressure (up to  $8.0 \times 10^{-6}$  Torr), Ar Gas is injected into a chamber and degree of vacuum changes.

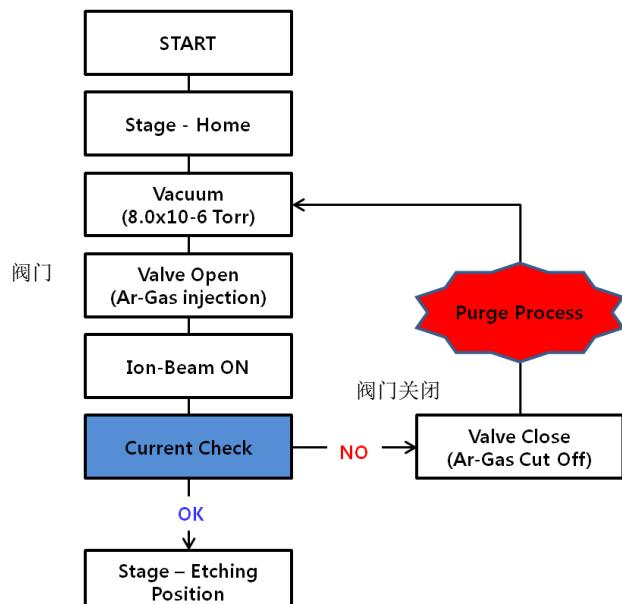
(Working Pressure: about  $3.5 \times 10^{-5}$  Torr)

Ion beam generated measures current value through Faraday Cup.

In case that current value is less than minimum current value according to acceleration voltage, beam recognized it unstable state and closes gas injection valve automatically and open and close again to check current value.

该功能包含在蚀刻流程中，无需用户亲自操作。是自动check的一个功能

※ This function is included in etching procedure and is not operated by a user in person.



- Diagram of Purge function -

| voltage     | Current (FDC) |
|-------------|---------------|
| 2kV ~ 2.9kV | < 20uA        |
| 3kV ~ 3.9kV | < 25uA        |
| 4kV ~ 4.9kV | < 30uA        |
| 5kV ~ 5.9kV | < 35uA        |
| 6kV ~ 6.9kV | < 40uA        |
| 7kV ~ 7.9kV | < 45uA        |
| 8kV         | < 50 uA       |

- Diagram of Purge minimum current-

如果离子束性能实施不当，可能会启动无限清除循环。（无法进行蚀刻）

If performance of Ion Beam is not implemented properly, infinite purge loop may start. (etching is not possible)

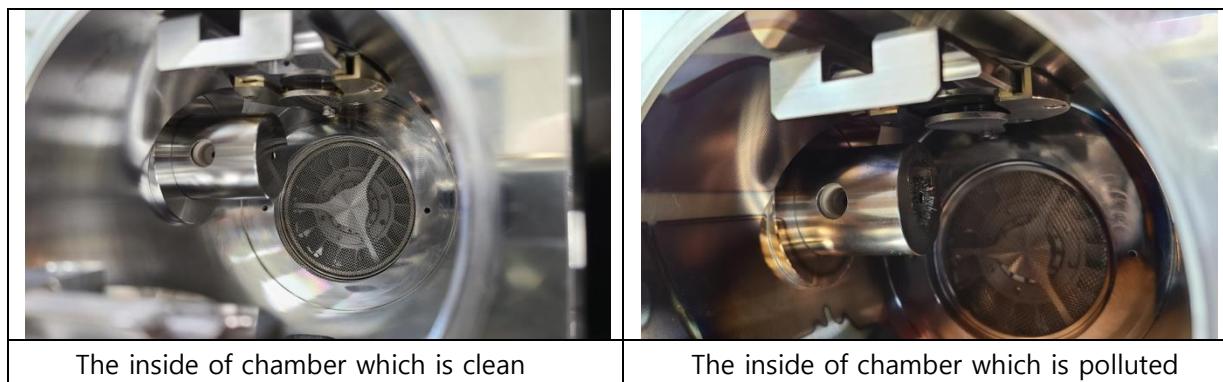


In such case, check residual Ar Gas amount, injection pipe connection and ion gun assembly. If you are unable to solve it on your own, contact A/S center.

## 9 Cleaning management

Particles that occur during etching contaminate a chamber and if you does not clean it for a long period, life of this product may be shortened significantly.

You need to clean the inside of a chamber, CCD protective glass cover, and ion gun in a cycle of accumulated operation time of 100 hours. 腔体内部、CCD保护玻璃盖、离子枪进行清洁。



If you fail to clean the inside of a chamber and ion gun in a cycle of 100 hours, it may cause this product to break down or life of this product to be shortened.

---

## 9.1 Chamber Cleaning

Dust from etching pollutes the inside of a chamber.

You need to keep this product clean by cleaning it periodically.

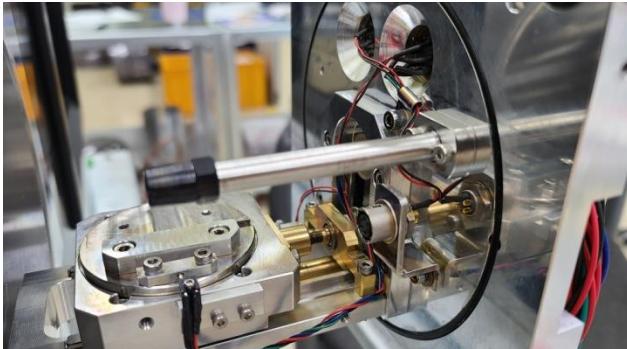
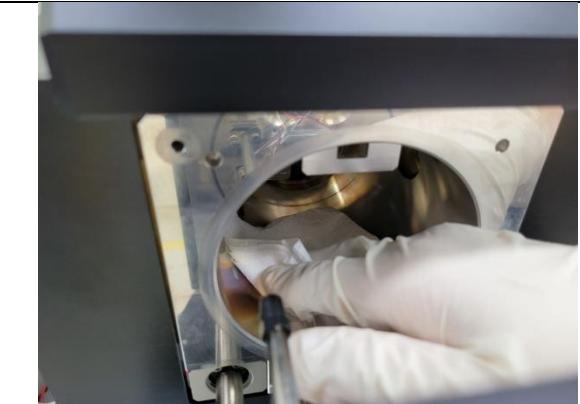
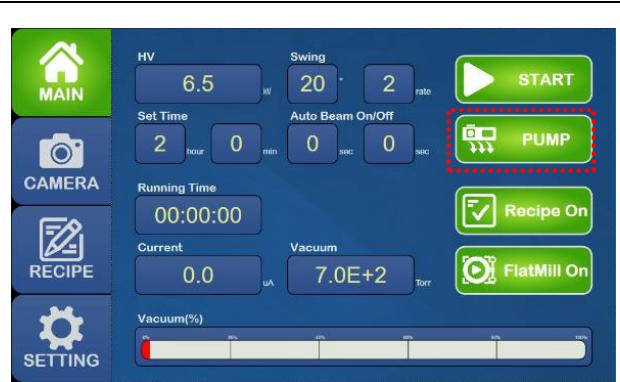
Clean chamber as outlined below.



- Preparations: Wipers, Ethanol (for Cleaning), Sanitary Gloves

抹布、乙醇（清洁用）、卫生手套

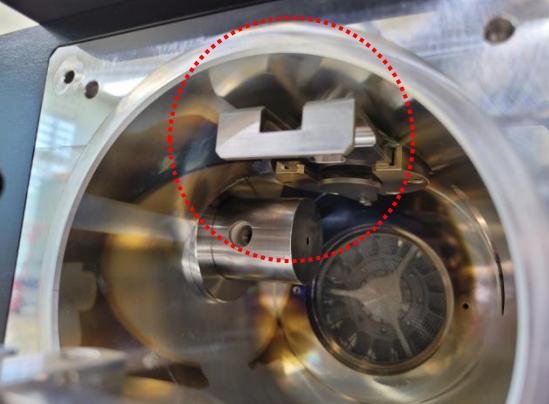
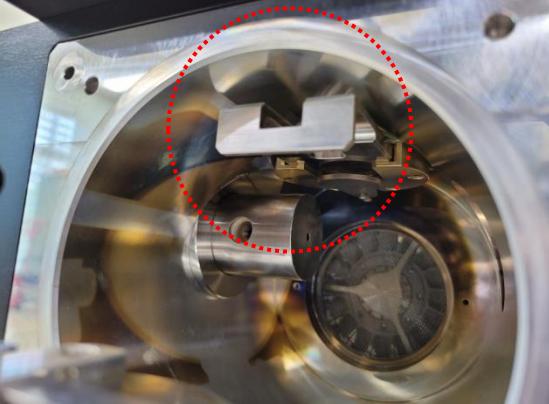
\* Make sure to wear sanitary gloves before work.

|   |   |
|---|---|
|    |   |
| 1) After VENT, open chamber door.   | 2) Wet certain amount of ethanol on wiper.  |
|   |  |
| 3) Clean the inside of chamber and stage by using wiper described in 2).<br><br>(You need to be careful about wiring during work) | 4) When ethanol drying ends, close chamber door and press PUMP button.              |

## 9.2 CCD Protective Glass Cover Cleaning

Dust from repeated etching pollutes the inside of a chamber.

You need to keep this product clean by cleaning protective glass cover which is mounted to prevent CCD camera from being polluted.

|  |  |
|--|--|
|   |    |
| 1) After venting this product, open chamber door and pull CCD protective glass cover mount jig in horizontal direction to remove it. | 2) Wet wiper in ethanol and then clean CCD protective glass cover and mount jig.   |
|   |  <p>The screenshot shows the control interface with several buttons and displays:</p> <ul style="list-style-type: none"> <li><b>MAIN</b>: HV 6.5 kV, Swing 20°, Auto Beam On/Off, Set Time 2 hour 0 min, 0 sec, 0 msec.</li> <li><b>CAMERA</b>: Running Time 00:00:00.</li> <li><b>RECIPE</b>: Current 0.0 uA, Vacuum 7.0E+2 Torr.</li> <li><b>SETTING</b>: Vacuum(%) scale from 0% to 100%.</li> <li><b>PUMP</b>: A green button with a pump icon, highlighted with a red dashed box.</li> <li><b>START</b>: A green button with a play icon.</li> <li><b>Recipe On</b>: A green button with a checkmark icon.</li> <li><b>FlatMill On</b>: A green button with a circular icon.</li> </ul> |
| 3) Mount CCD protective glass cover mount jig on the top of chamber door.  | 4) When ethanol drying ends, close chamber door and press PUMP button.   |



If alien substance enters CCD protective cover part which is connected to vacuum gauge or O-ring is missing or damaged during detachment/attachment, vacuum does not form which requires your special attention.

## 9.3 Ion Gun Cleaning

Ion Gun needs to be cleaned in a cycle of 100 hours.

You need to clean as outlined below.

钕磁铁具有强磁性。请注意不要因受磁性影响的物质相互附着或受到冲击而损坏磁铁，并且零件之间应保持恒定的间隙。

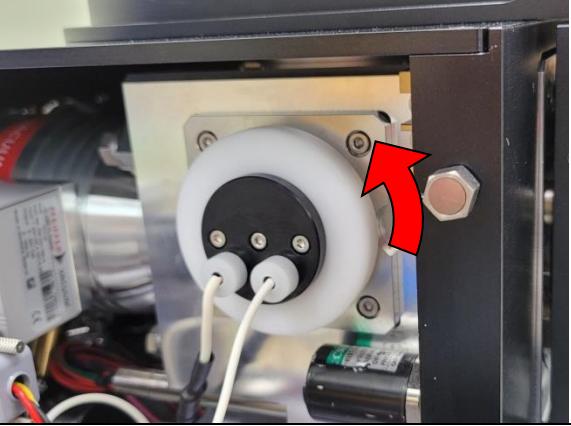
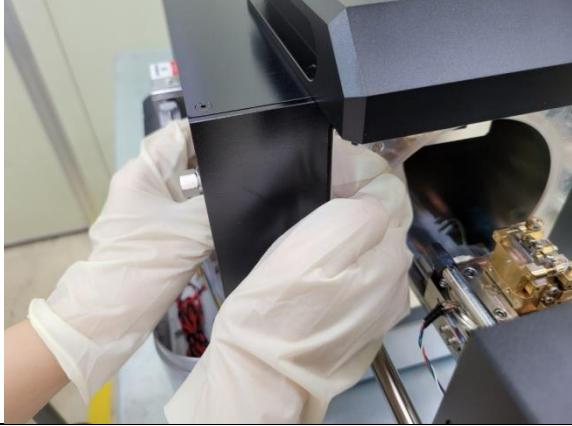
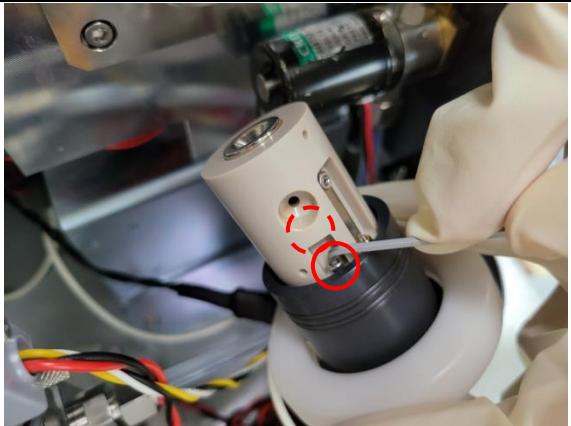


- Be careful not to affect vacuum gauge, Ar Gas pipe and wiring while working.
- Neodymium is strongly magnetic. You should be careful that magnet will not be broken by substances affected by magnetism being attached each other or by shock and parts maintain constant interval.

### 9.3.1 Separating Ion Gun

Make sure to wear sanitary gloves before work.

|   |   |
|---|---|
|   |   |
| 1) Turn on power and press VENT button.                       | 2) Open chamber door and if there is sample holder, remove sample holder.                   |
|   |   |
| 3) Turn off power at the side of this product and main power. | 4) Remove knurling knob on the cover on the left of this product and then separate a cover. |

|   |  |
|---|--|
|    |              |
| 5) Turn ion gun fixing nut counterclockwise to release it.                          | 6) Hold Ion Gun body by one hand and push the front of ion gun by the other hand to remove it. |
|   |             |
| 7) Remove injection plate.  | 8) Remove 2 tier insulation housing.   |
|  |            |
| 9) Remove two hexagonal wrench bolts (M2.5) connected to a body.                    | 10) Detach insulation housing from a body.   |

|  |  |
|--|--|
|   |    |
| 11) Slightly unfasten nuts (2EA) connected to electrode-cathode by using long nose.<br>阴极  | 12) Slightly unfasten nut connected to electrode-anode by using long nose.<br>阳极   |
|    |   |
| 13) Unfasten three headless bolts (M2)<br>钕磁铁<br>connected to plate hole neodymium magnet.<br>(unfasten slightly enough to remove plate hole<br>neodymium magnet.) | 14) Remove plate hole neodymium magnet.  |
|   |    |
| 15) Remove upper plate.  | 16) Turn insulation housing upside down and<br>unfasten five headless bolts (M2) and remove<br>round neodymium magnet. (unfasten slightly<br>enough to remove neodymium magnet.) |

稍微松开即可取出钕磁铁

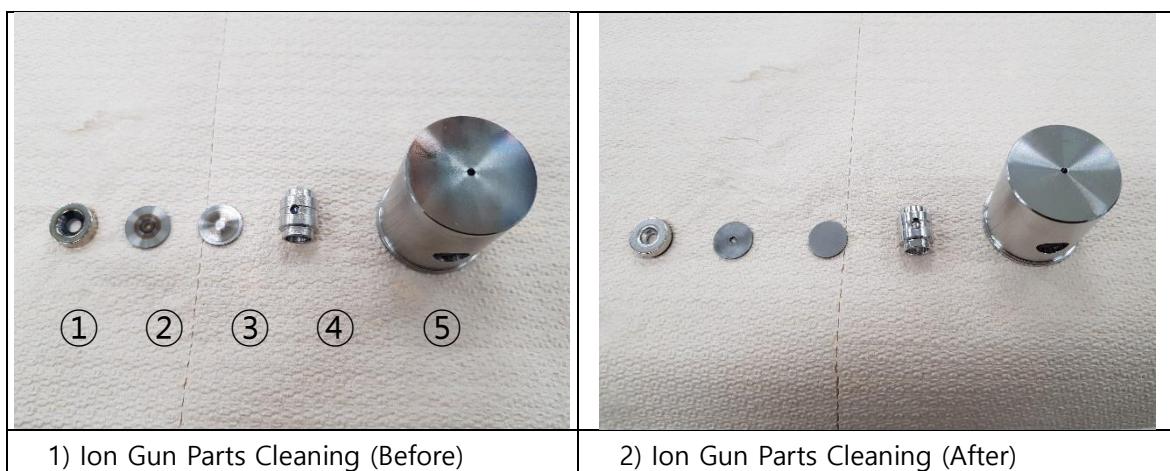
|  |   |
|--|---|
|   |   |
| 17) Remove lower plate.  | 18) Unfasten two headless bolts (M2) enough to remove inner container.              |
|  |  |
| 19) Push inner container towards the front to remove it.                           | 20) Organize parts in order not to lose them.                                       |



Separation, cleaning and assembling of Ion Gun require long and hard work.  
If you keep this product in a vent state, it may cause this product to be deteriorated due to pollution of chamber. Equipping ion gun body after detaching insulation housing and keeping pump state helps performance of degree of vacuum of chamber.

### 9.3.2 Cleaning Ion Gun Parts

Clean parts shown below among parts of Ion Gun with Pikal and ethanol.



- ① Plate hole neodymium magnet
- ② Upper plate
- ③ Lower plate
- ④ Inner container
- ⑤ Injection plate

\* When cleaning parts of Ion Gun, be careful that there will not remain impurities.

(In case that cleaning is wrong, CP-8000+ may not function or performance of Ion-Gun may be deteriorated.)



- Case that cleaning is wrong (Pikal residue in upper plate hole ) -

### 9.3.3 Assembling Ion Gun

After finishing cleaning of all parts of Ion Gun, assemble Ion Gun as outlined below.



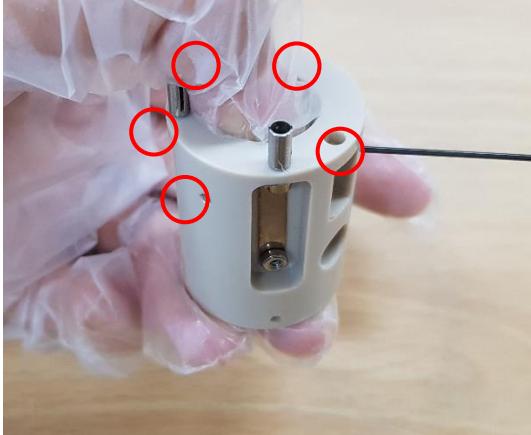
**NOTE**

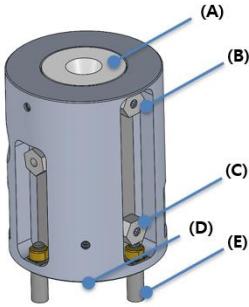
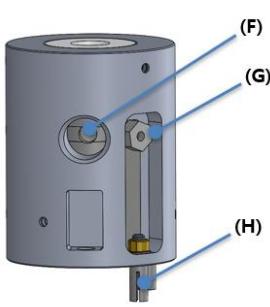
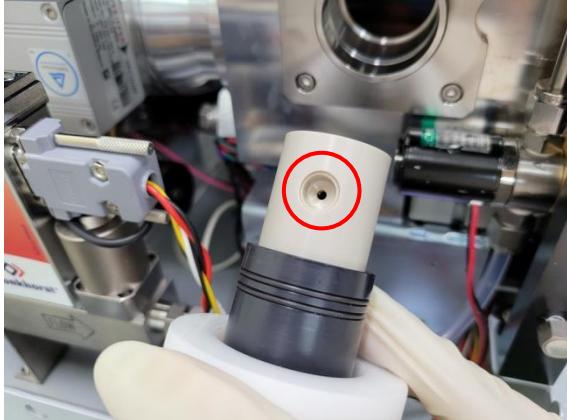
\* You need to assemble neodymium magnets when they operate by the attraction each other.

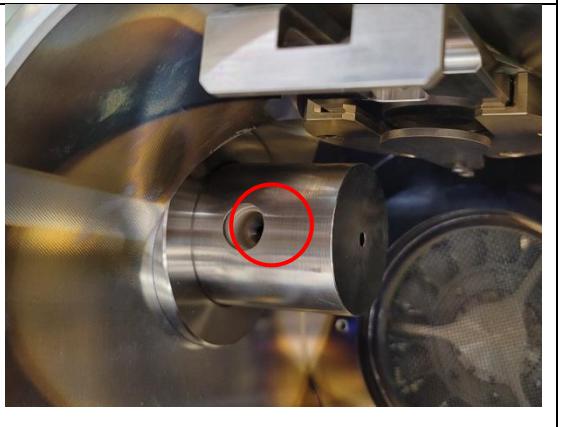
(Neodymium is ferromagnetic material and thus when repulsive force works, assembling is not possible.)

\* When assembling upper and lower plates, you need to press and fix plate.  
(If plate is not fixed properly, it may affect performance of ion gun.)

|  |  |
|--|--|
|                    |               |
| 1) Put inner container into the front and match insulation housing to the center of inner container. | 2) Fix two headless bolts (M2) with inner container pressed by hand at the front.                |
|                   |              |
| 3) Fasten nuts connected to headless bolt to the end by using long nose.                             | 4) Turn insulation housing upside down and insert lower plate and press plate by hand to fix it. |

|  |  |
|--|--|
|   |                      |
| 5) Put round neodymium magnet on lower plate in such a way that it is located at the center of inner container and fix five headless bolts (M2) by it pressed by hand. | 6) Turn insulation housing upside down again and insert upper plate and press plate by hand to fix it. |
|    |                     |
| 7) Put plate hole neodymium magnet on upper plate.   | 8) Put magnetic align jig on magnet and then press jig by hand.  |
|   |                    |
| 9) Check if align jig rotates without gap locking headless bolts slightly.   | 10) Make it possible for align jig to rotate without gap with headless bolts fastened.                 |

|  |  |
|--|--|
|           |                                |
| <p>11) Connect nut in the direction of plate hole neodymium by using long nose.</p>        | <p>12) Attach and detach long nose to and from plate hole neodymium to check connection of neodymium.</p>        |
|          |                               |
| <p>13) Check A-B-C-D-E current carrying by using multi tester.</p>                         | <p>14) Check F-G-H current carrying by using multi tester .</p>  |
|         |                              |
| <p>15) Insert inner container into body cover and connect 2EA fixing screws to fix it.</p> | <p>16) Connect 2 tier insulation housing in such a way that center matches inner hole in insulation housing.</p> |

|  |  |
|--|--|
|                       |    |
| 17) Connect injection plate adjusting to central hole in 16).  | 18) Arrange to reference axis connecting point and insert ion gun.                   |
|                      |   |
| 19) Insert to the end and turn ion gun fixing nut clockwise to fix and finish installation of ion gun. | 20) Check concentric condition of injection plate.                                   |
|                     |  |
| 21) Close chamber door and PUMP.   | 22) Place left side cover and then fix knurling knob.                                |



\* If you fail to check short circuit of parts assembled to insulation housing when you assemble ion gun, it may cause ion gun not to function.

When finishing all works, conduct [6.4 Ion Beam Align] procedure.

---

## 10 Trouble Shooting

In case that performance of a product is lower than normal level, you can check condition of this product as outlined below to restore it to normal level.

If performance of this product is abnormal even after you work as outlined below, you need to contact service center.

### 10.1 In case you fail to achieve etching rate

You can identify performance or condition of this product according to Si Bare Wafer(Standard Sample) etching rate result depending on conditions described in a table below.

| CP-8000+ Reference Etching Rate |          |
|---------------------------------|----------|
| Sample                          | Si Wafer |
| Acc Voltage                     | 8kV      |
| Sample Height (Mask to Sample)  | 30um     |
| Flow gauge                      | 0.1Mpa   |
| Run Time                        | 1Hour    |
| Auto Beam                       | Off      |
| Swing                           | ±30°     |
| Etching Rate                    | 500um ↑  |

There may occur cases that performance of product (etching rate) due to wrong setting of this product or poor sample preparation.

Let's find cases that you fail to achieve etching rate.

### 10.1.1 Checking a flow

Check if a flow on flow gauge is at proper level (0.1Mpa).

If Ar Gas is exhausted, you need to recharge gas.



Example) pressure condition on a regulator



If you operate this product with Ar Gas exhausted, ion beam does not generate.

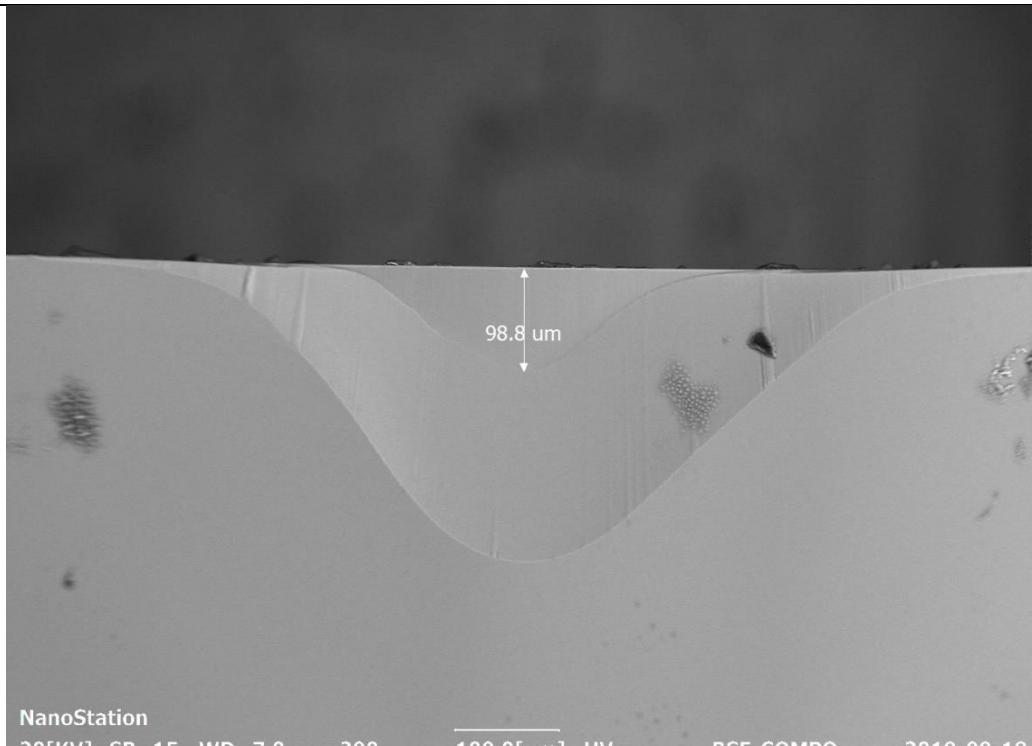
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## 10.2 Predicting etching setting condition through SEM IMAGING

Let's find out cases that setting is wrong watching image result and observing sample which etching is completed through COXEM electronic microscope (SEM) image.

### CASE 1

Massage Area is shown greater than Etching Area.



NanoStation

20[KV] SP=15 WD=7.0 x200

100.0[um] HV

BSE-COMPO

2019-09-18

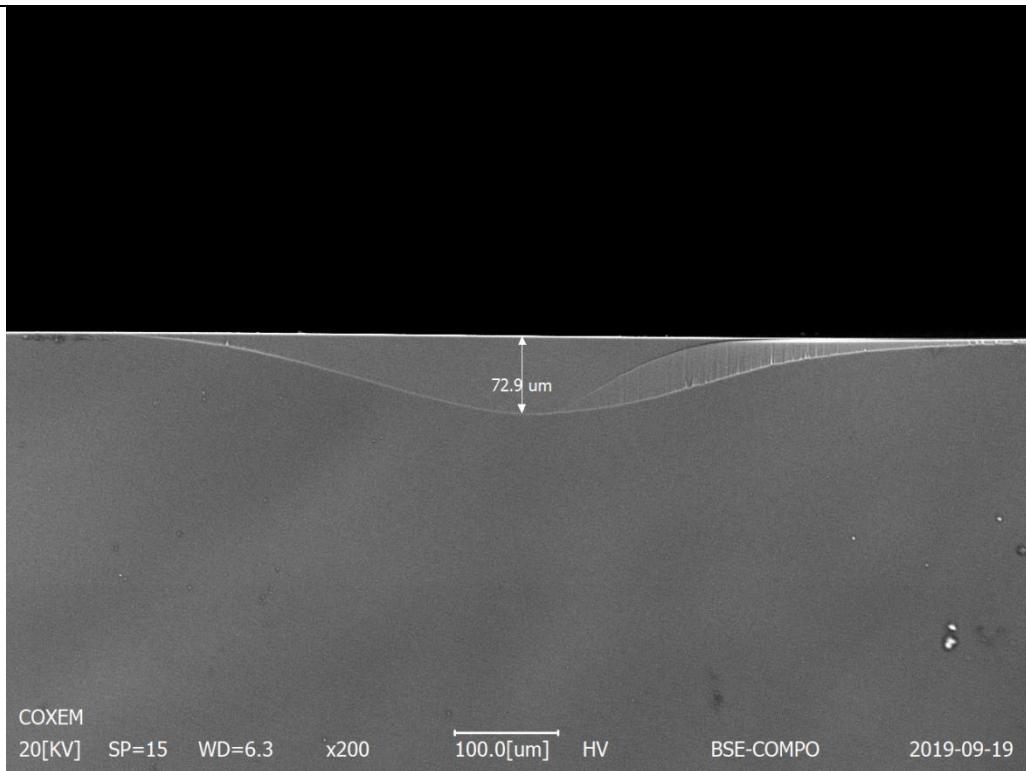
Matters that require examination when setting

The height of a sample is inappropriate.

You need to determine and check the height of a sample by using height adjusting jig of 30um or 50um.

CASE 2

Etching Area including Massage Area is shown too short.



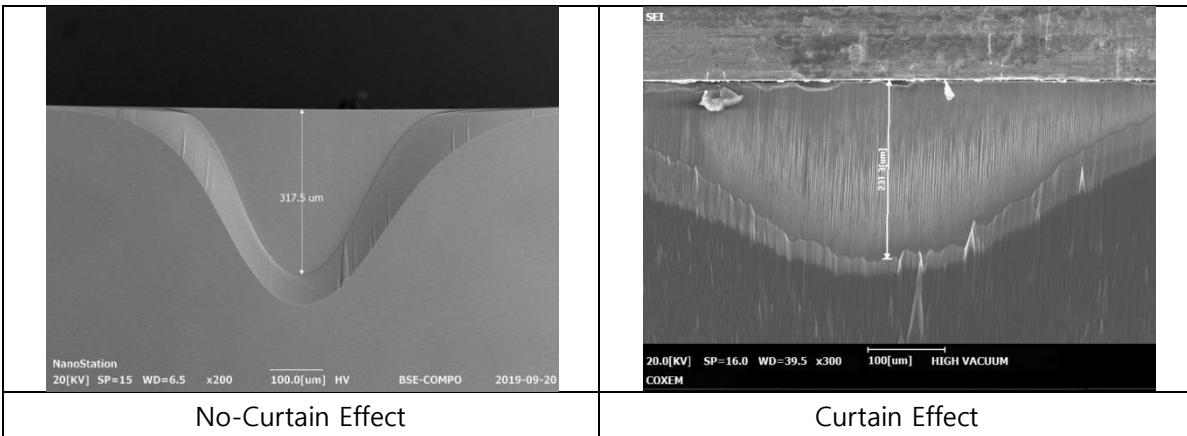
Matters that require examination when setting

Gun Align position is inappropriate.

You need to check beam shape, current value, beam position etc. through [6.4 Ion Gun Align].

## CASE 3

Curtain Effect which etched surface looks curved not smooth occurs.

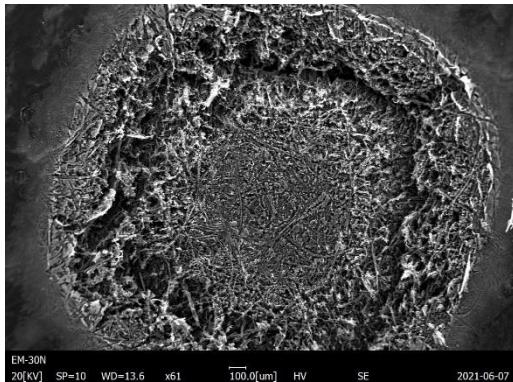


## Matters that require examination when setting

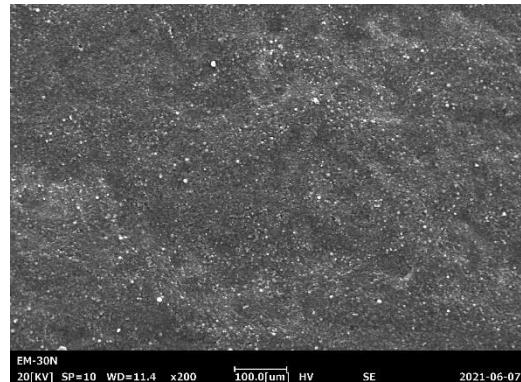
1. Check if there is gap between sample and mask.
2. Check cleanliness of etched side in sample and mask.
  - \* If you etch with lots of pollutants on etched side, above mentioned effect may occur.
3. Use Swing Mode
  - \* If you use Swing mode at about 15°~30°, you can get more smooth etching surface.
4. Use Step by Step Mode
  - \* Minimize curtain effect sufficiently passing through massage mode which proceeds automatically after etching ends.

CASE 4

If you fail to fix a sample at the center at the time of flat milling, etched area does not appear.



When a sample is in position



When a sample is out of position

Matters that require examination when setting

1. Check if a sample is attached at the center of flat milling sample side.
2. Check if sample fixing plate is on central part of Flat stage.
3. Check if Flat Milling Holder is mounted on stage properly.

## 10.3 In case you fail to achieve ion beam current

In case you fail to achieve proper ion beam current with beam current value out of appropriate level even after purge function operates when you proceed with etching, check the following matters.

### 10.3.1 Checking Faraday Cup Condition

Check cleanliness and grounding condition of faraday cup which measures beam current value in a chamber.



### 10.3.2 Checking Residual Amount of Ar Gas

Check residual amount of gas and regulator pressure.



Example) Regulator pressure condition