

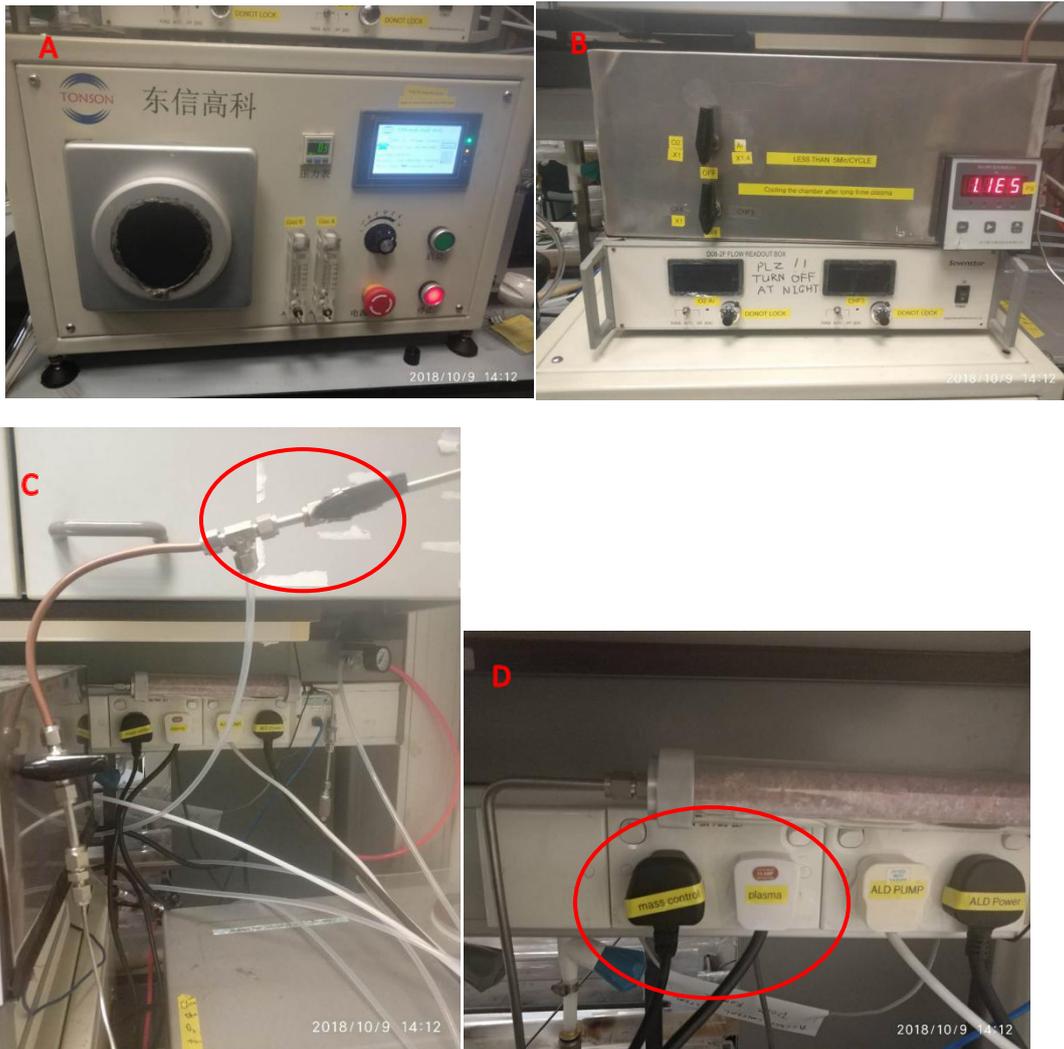
Dry Etch and Plasma System

Edit on Oct. 10th,2018

1. Scope

1.1 This document provides operating procedures and requirements to etch silicon or silica with gas plasma system.

2. Equipment Structure



For the plasma etcher's structure, the picture A is the plasma chamber, B is the mass controller of the gas, like O_2 , CHF_3 , CF_4 . Then, C is the O_2 gas lines and it's valve. D is the power switch for plasma and mass controller.

3. Before starting: Important note

3.1 You have to be authorized by Dr. Tang and properly trained by Dr. Tang's group

member before operate the system.

3.2 After plasma treatment, the samples could be very hot.

3.3 If use the highest power, the plasma can only be turned ON for less than 5min. You can turn plasma power back ON after 3mins cooling. If use power 6, plasma can only be turned ON for less than 10min; otherwise, the power supply will overheat and be damaged.

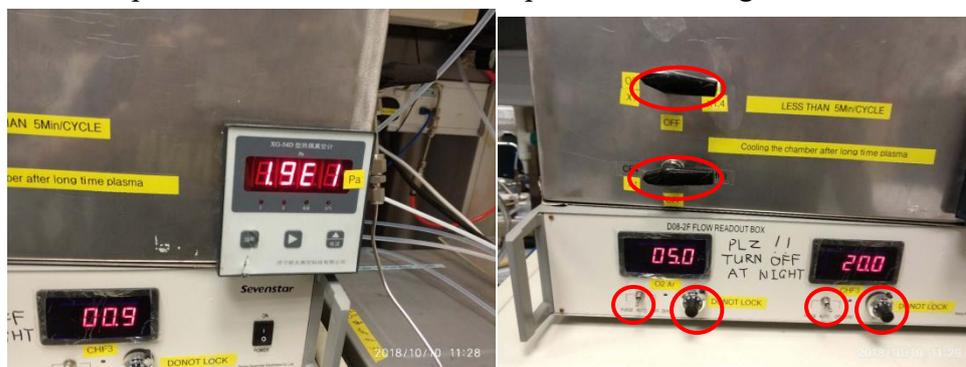
3.4 In the evening, the people who is the last one to use the plasma etcher should turn off the power switch as shown in Picture D.

4. Operating Procedures

4.1 Load samples in the chamber. Manual Screen→Manual On→Vacuum pump ON→Using B gas



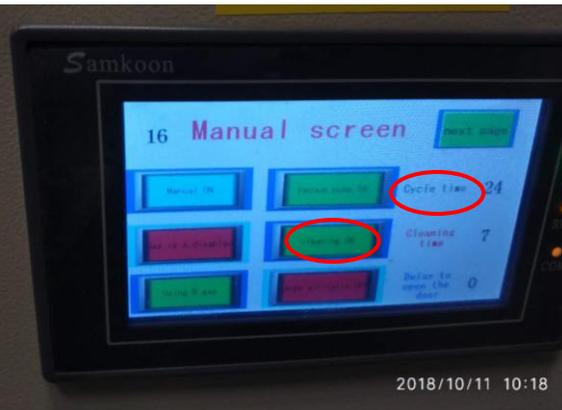
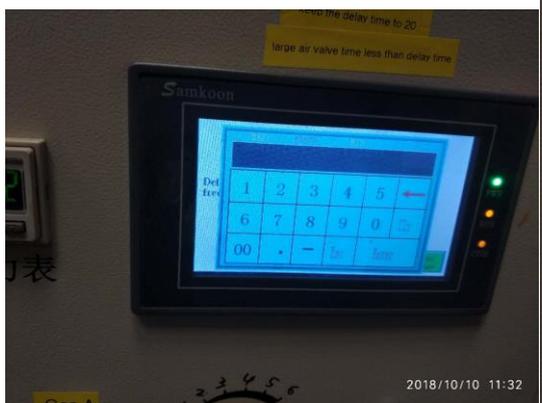
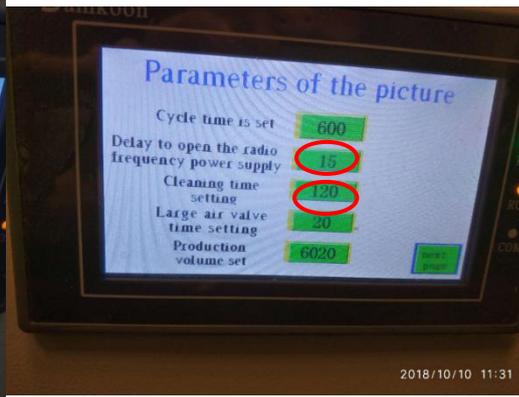
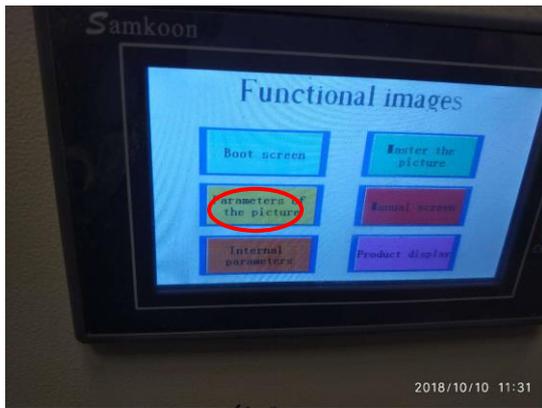
4.2 After pressure is lower than 20Pa. Open the reaction gas.



For example, if you want to supply 5sccm O₂ with 20sccm CHF₃ to etching chamber. Black arrow point to O₂→White button point to AUTO→Use the black knob to change the O₂ Flow rate to 5sccm. Set CHF₃ to 20sccm with similar process.

4.3 Set etching time

Click the *next page* in Manual Screen→Functional images→Parameters. Just change the *cleaning time setting* as you need. Click the button as show in red ring on the follow picture. Then enter the clean time and click the *Enter* to get back to *Parameters of the picture*. Same process to set the *Delay time(delay to open the radio frequency power supply)*. Click the *next page* to Functional images. Then get into Manual Screen.



4.4 Wait until pressure stabilized for 1min. After the **Cycle time** is larger than setting value of **Delay time**. Click the **cleaning on** to start the etch process, you can observe the chamber, and you will see the **plasma glow**.

4.5 Close process

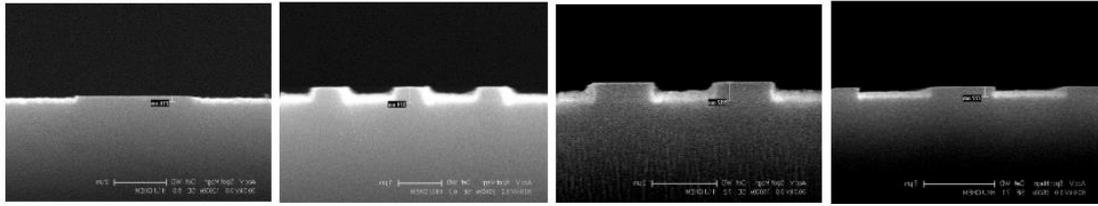
After the Cycle time reached the setting value. Then Click the **cleaning on** again (the color change from green to red) to turn off the plasma. Then close all gas. After more than 30s, click Using B gas → Vacuum pump ON → Large air valve ON. Then get out the sample. **No continuous etching for more than 10min under power 6 or 5 min under full power is allowed.**

5. Sample Etching Receipt

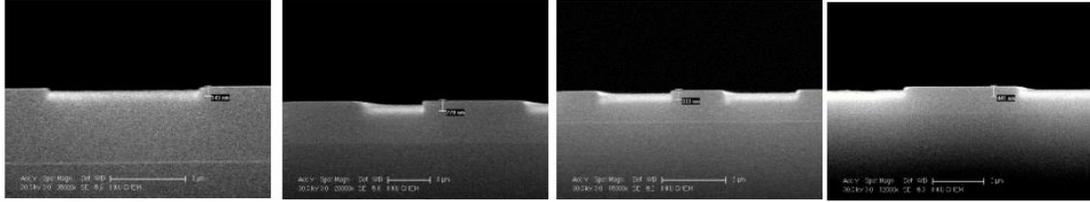
5.1 Silicon/Silica etching

20sccm CHF₃+5sccm O₂, power 6.

Etch rate: Silicon: 20nm/minute Silica: 10nm/minute



Etch rate of Silicon: 10mins 20mins 30mins 40mins



Etch rate of Silica: 10mins 20mins 30mins 40mins

6. Questions for Operation

6.1 During the etching process, for example, a student wants to use CF_4 and O_2 to etch silicon for many cycles. For each cycle, after he/she adjusts the flow rate and opens the gas valve, he/she immediately turns on the cleaning. Is this operation right? Why?

6.2 A student sets a proper flow rate, opens the valve and waits for the pressure to be stable, then he/she turns on the cleaning. However, he/she finds there is no plasma glow in the chamber. Do you know why the plasma is not started?

6.3 A student uses the maximum power to do the silicon etching, each etching cycle time is 5 min. In order to save time, he/she doesn't wait any time between two cycles. Is his/her operation right? Why?

6.4 After you finish your plasma experiment, what things should you do? (Hints: turn off cleaning on or shut down power? Gas? Sample?)