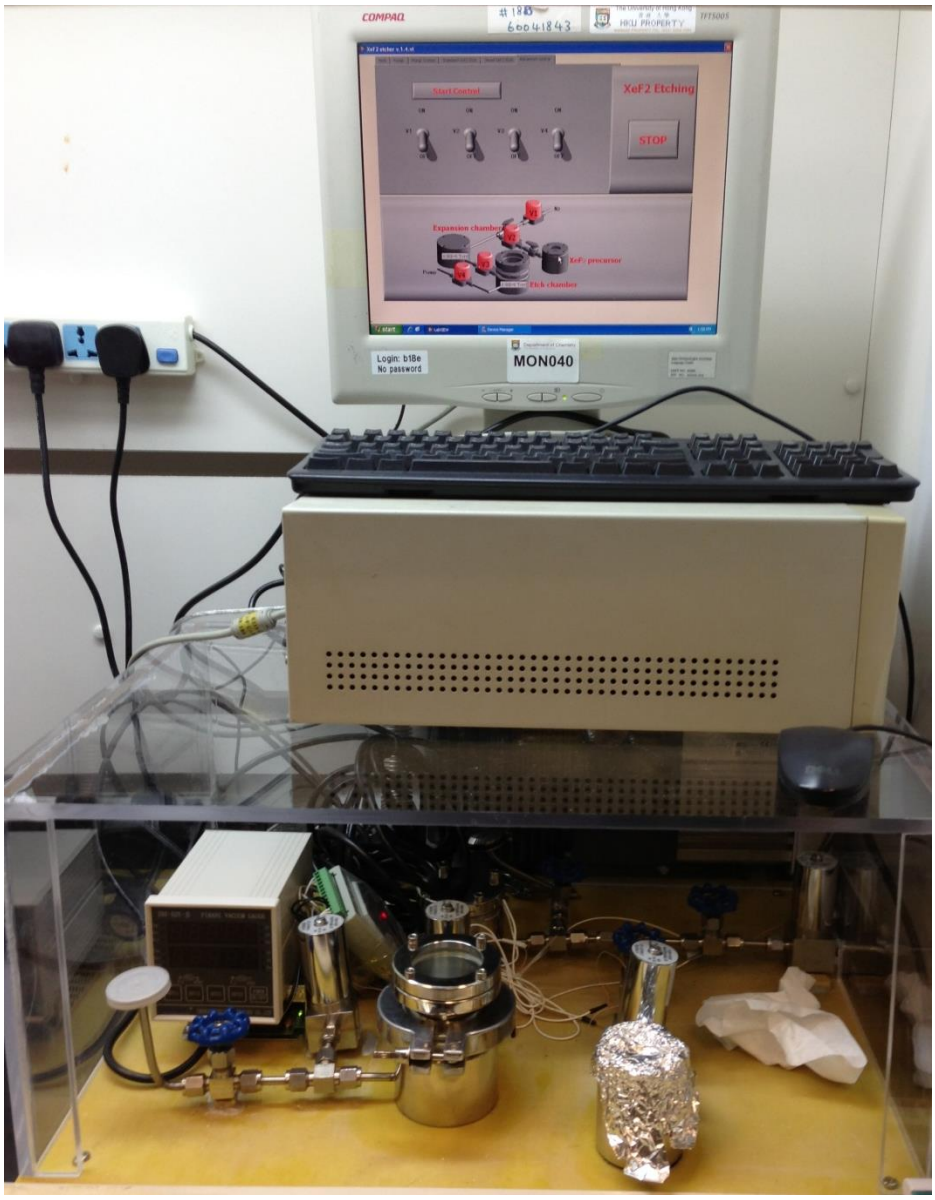
XENON DIFLUORIDE ETCHING SYSTEM



1. Scope

1.1 This document provides operating procedures and requirements to etch silicon with XeF_2 gas phase etching system.

1.2 System description

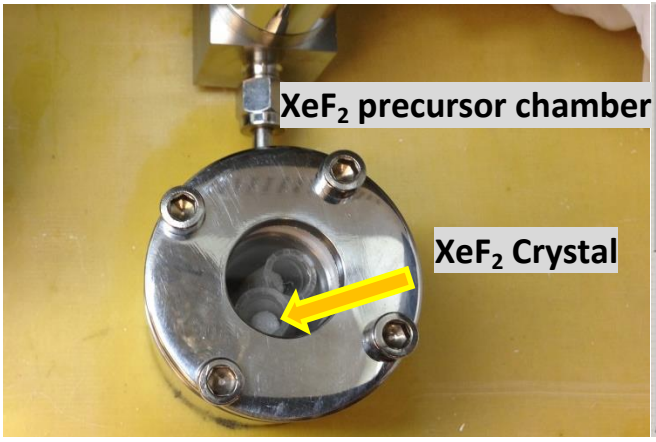
This is a system designed to expose samples to xenon difluoride gas (XeF_2) in a cyclic mode in which the etch chamber is repeatedly filled with XeF_2 gas and pumped out again. Since the etch chamber inner diameter is 50mm, sample with smaller size is possible.

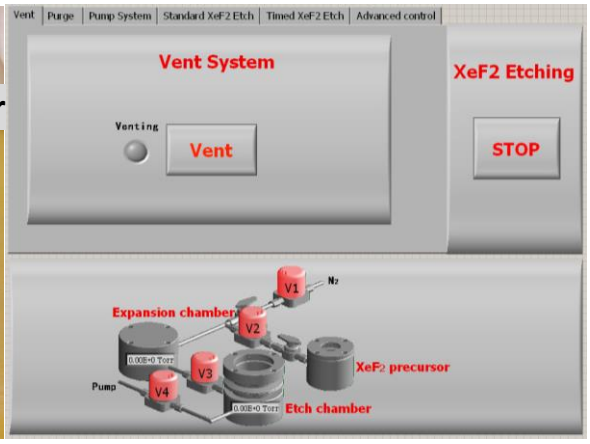
2. Before starting: Important note

2.1 You have to be authorized by Dr. Tang and properly trained by Dr. Tang's group member before operate the system.

2.2 Contrary to rumor, XeF_2 does not explode upon contact with air or moisture. This is typically confused with XeF_4, a compound which can react with moisture to form an explosive. Fortunately, all XeF_2 used here has only trace impurities of XeF_4, and it is not dangerous as a potential explosive.

3. Operation instruction





Load/Unload

3.1 Before load your sample, check the XeF_2 precursor chamber, make sure it is not exhausted.

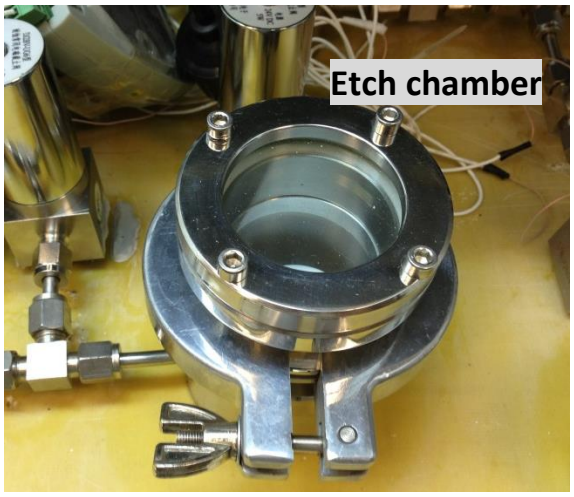
3.2 Switch on the roughning pump and open the valve of N_2.

3.3 (Optional) If the system has not been used for more than 12 hours, the air has leaked inside precursor chamber. In order to pump it down to vaccum, select "pump" tab in program and press " pump the whole system". This is open valve V2, V3 and V4. Keep pump for ~20s, and press pump etch &expansion chamber , the close V4. Make sure do not pump the whole system for long time, since it will quickly deplete XeF_2 presursor. If the system was in use before your session, skip this step.

3.4 Select "Vent" tab in program and press "Vent", the indicator "Venting" will light-up which indicate the venting cycle is started. Depress "Vent" bottom, otherwise the system will start over the venting cycles again after finished.

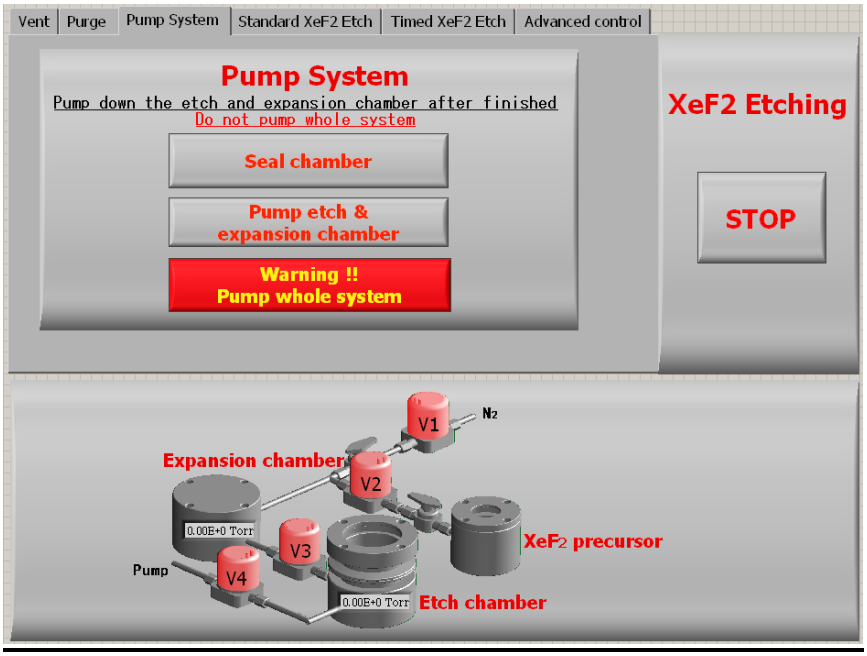
3.5 System will automatically purge and vent chamber several times. Wait for "Venting" indicator turned off before open the etch chamber.

3.6 Open the etch chamber by unscrew the clap and load your sample inside.



3.7 Close the chamber and hand tight the clap.

3.8 Select “pump” tab in program menu, and press “ pump etch &expansion chamber”.



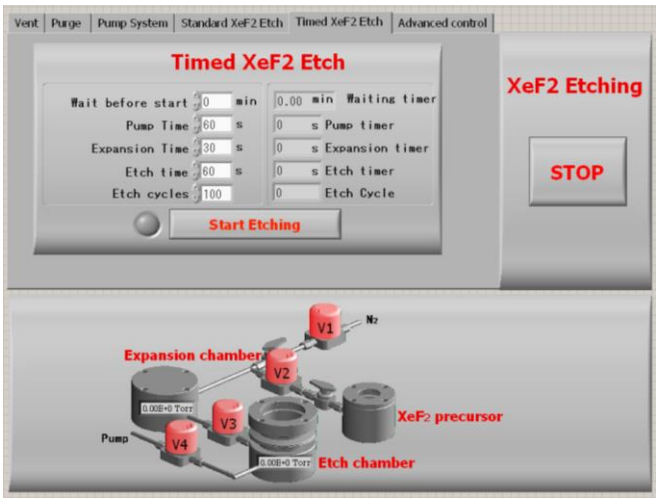
Etch run – Timed etch mode (only mode available)

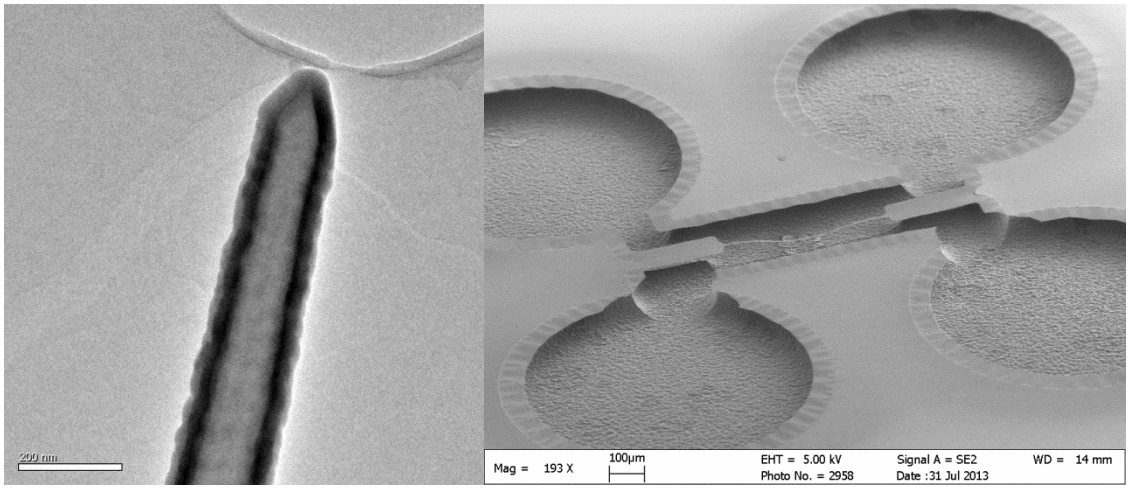
3.9 Select “Timed XeF_2 Etch” tap, input desired # of cycles, and waiting time. (other parameter do not needs to be changed, if you want to change receipt, please ask superuser)

3.10 Press “Start Etching” bottom, the etching procedure will be started and indicator on the left will be turned on.

3.11 Etch cycles will end automatically when last cycle is finished as indicated by indicator.

3.12 This receipt is calibrated to etch roughly 2.6μm/cycle and can be used to make hollow nanotube structure and suspended SiO_2 structure.





Nanotube made by XeF_2 etch

SiO2 suspended beam made by XeF_2 etch

Shut down

3.13 Vent the chamber and remove your sample

3.14 Pump the system back by click Pump etch & expansion chamber

3.15 Pump system for 1min, then Seal the system by press Seal chamber

3.15 Turn-off pump and close valve of N_2