

**Author:** Chin Pang (Billy) Siu; Edited by Mario Beaudoin  
**Email:** [scpbilly@interchange.ubc.ca](mailto:scpbilly@interchange.ubc.ca); [Beaudoin@physics.ubc.ca](mailto:Beaudoin@physics.ubc.ca)  
**Phone:** 604-822-1853(MB).

## Purpose

This document outlines the standard operation of isotropic silicon dry etch with the XACTIX, xenon difluoride (XeF<sub>2</sub>) etching system (Xetch e1 Series), located in the thin film area of the AMPEL Cleanroom. This document provides pictorial guidance for users on typical operations but does not include all details and explanations. This document directs users are to relevant information listed in the text. Operation is only allowed for qualified users with authorized password.

## Relevant information

### Operation

- Xetch e1 Series System Manual
- [http://www.xactix.com/Xetch\\_overview.htm](http://www.xactix.com/Xetch_overview.htm)

### Process parameter estimation

- <http://www.mems-exchange.org/catalog/P2316/>
- P. B. Chu, S. J. Pister, et al; "Controlled pulse-etching with xenon difluoride," Solid State Sensors and Actuators, 1997. TRANSDUCERS '97 Chicago, 1997 International Conference on  
Publication Date: 16-19 Jun 1997, Vol 1, pp665-668

## Section 1: Foreword

- The instrument consists of four units: computer, etching machinery, microscope with CCD, and illuminator. (Figure 1.1)

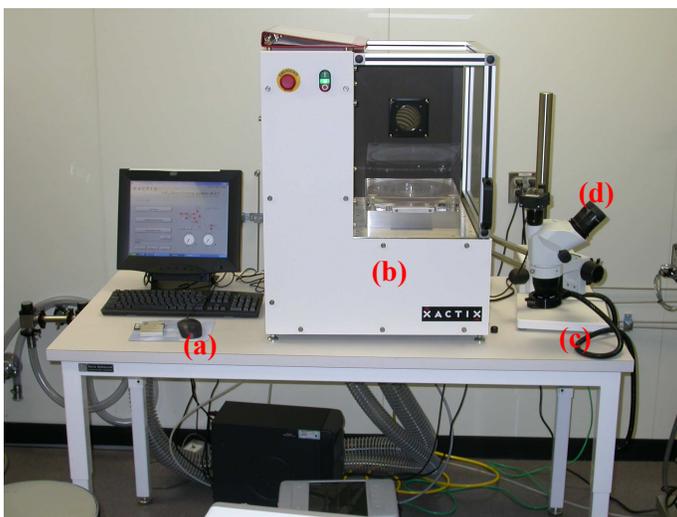


Figure 1.1: Xetch XeF<sub>2</sub> etching system,  
(a) computer,  
(b) etching machinery  
(c) CCD microscope  
(d) lamp located behind the microscope

- In the etching process, XeF<sub>2</sub> gas is the reactant and SiF<sub>4</sub> vapor is the main product in silicon etching. For safety purpose, the user should be familiar those and other possible chemical products generated in his/her process. Please consult the MSDS before doing any operation.
- Nitrogen and dry air are the other required gases for operation: an inadequate supply of these will lead to machine malfunction. Before operating the etcher, check that the N<sub>2</sub> supply gas gauge reads 20 PSI; the gas tanks are in the chase area (Figure 1.2). Dry air is supplied by the building and should be in the 70~100 PSI range.



Figure 1.2: Ample N<sub>2</sub> supply required for proper etching and machine operation

- Machine is normally ready for use with a green LED indicator in the front side (Figure 1.3). There is “NO” need to press the Power ON/OFF button before and after usage

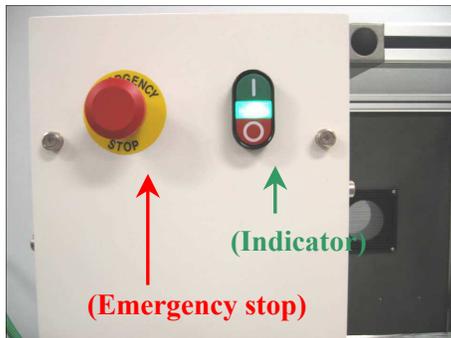


Figure 1.3: Green light indicator shows the machine in stand by status

- Press the emergency button to terminate electricity connection if any gas leak, fire or malfunction happens. (Figure 1,3), and report to cleanroom manager. However, it is **NOT** for the termination of any etching process. For this purpose, please refer to Section 2, step 16.
- Sample can be masked with photo-resist, silicon dioxide, silicon nitride and aluminum: the user should consider the selectivity before etching.
- For better etching result, a short baking of the sample prior to insertion in the chamber is recommended to reduce the moisture.
- Any software and hardware installation on the computer is prohibited unless approval is obtained from the cleanroom manager as it could lead to machine malfunction. This is a general rule that applies to any computer in the cleanroom.

- User is required to write down the operation in the log book for reference.

**Section 2: Operation procedure**

1. Machine is fully controlled by Xetch Labview program installed in the computer. Usually the program is already in the login window. Here, we start from the very beginning; assuming the program has been completely shut.

Click “All Programs” for “Xactix” and double clicks “Xetch” (Figure 2.1)

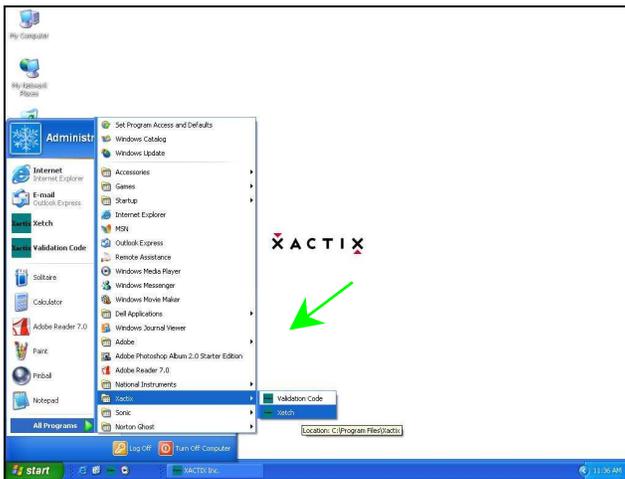


Figure 2.1

2. Under “Machine Startup Operation menu”, click “Normal (Recommended)” (Figure 2.2). If no choice is made for 60 sec, Normal mode is selected by default. It takes about 5min for chamber purging, and then user can login in the “Enter Login Information” dialog box. (Figure 2.3)



Figure 2.2

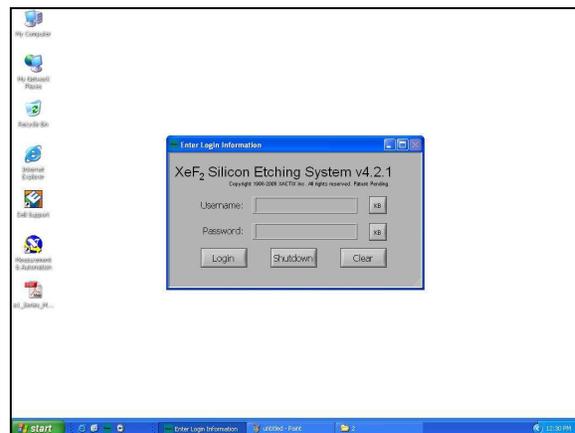


Figure 2.3

3. “Main menu” is then displayed and “Ready” is indicated in the “Machine status”. (Figure 2.4). Click the “Load/Unload Simple” button.

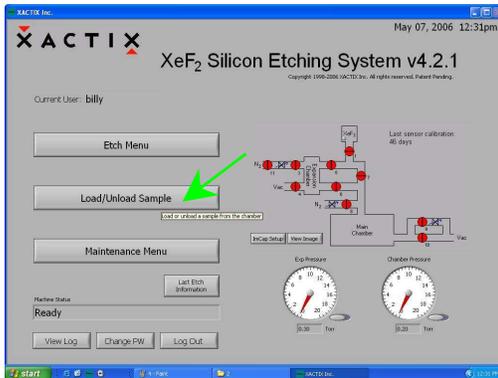


Figure 2.4

4. Under the Load/Unload Sample window, clicks “Yes” in the “Do you wish to load/change the sample” dialog box; the user can then prepare the sample for loading inside the chamber. (Figure 2.5)

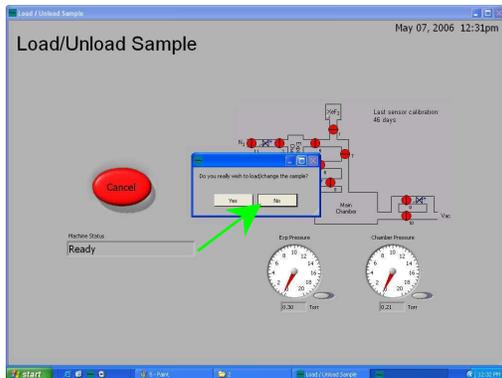


Figure 2.5

5. Open the chamber lid when “Waiting for user” is displayed in the “Machine Status” and put sample inside the chamber (Figure 2.6). No button needs to be clicked before you close the lid.

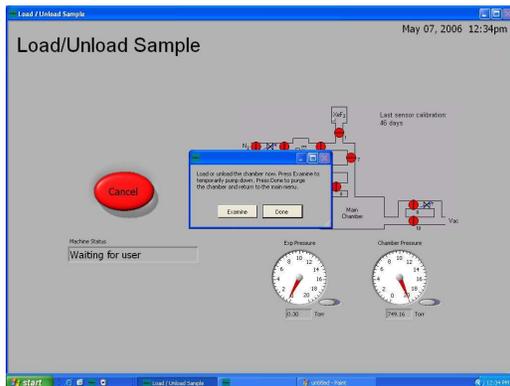


Figure 2.6

6. Check the black O-ring sealing, if it adheres on the lid, put it back to the metal rack and then close the lip. After that click the “**Done**” button. (Figures 2.7 and 2.8)

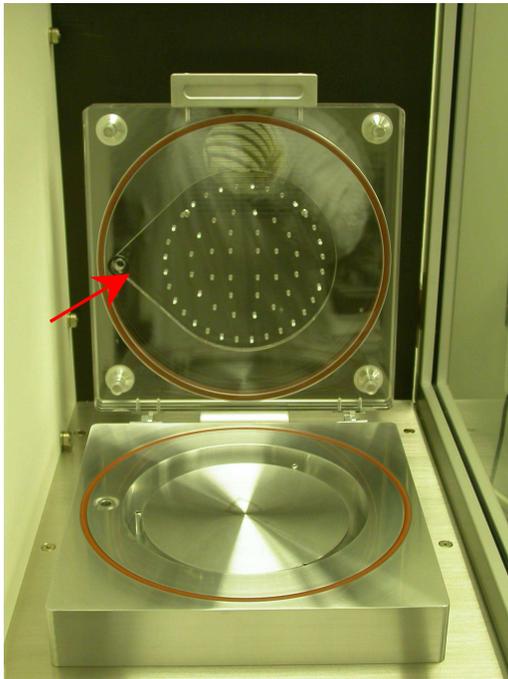


Figure 2.7

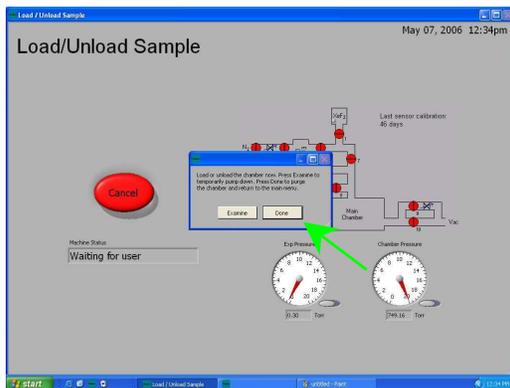


Figure 2.8

7. Main menu appears after chamber pump down. Click “**Etch Menu**” button for parametric setting (Figure 2.9)



Figure 2.9

8. Key in any number in the **Enter Lot number** for process trace back (Figure 2.10)

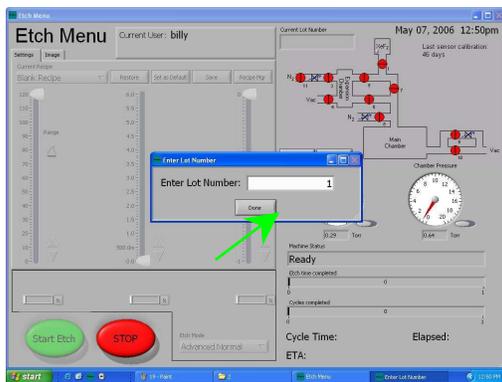


Figure 2.10

9. Under “**Current recipe**” (Figure 2.11), choose stored recipes (eg. “**Normal**”) or define a new one by altering the scale bars or press the “N” button for keypad input. To save a new recipe, click “**Save**” and input recipe name. (Figure 2.12) To undo alteration, press “**Restore**”.

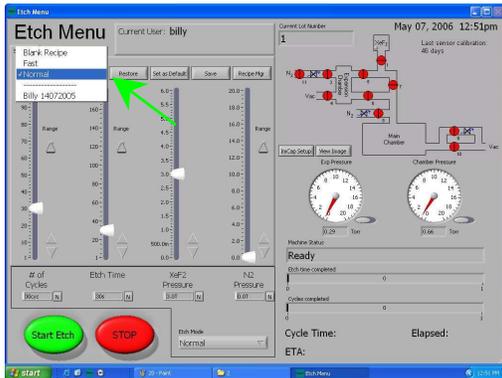


Figure 2.11

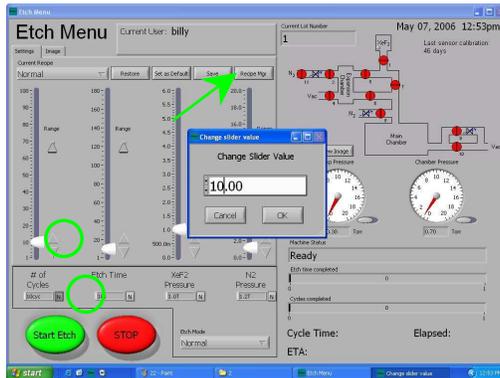


Figure 2.12

10. Step 10 to 14 are optional for capturing images of sample throughout etching. Move the chamber ventilation shroud backward for microscope positioning. (Figure 2.13).

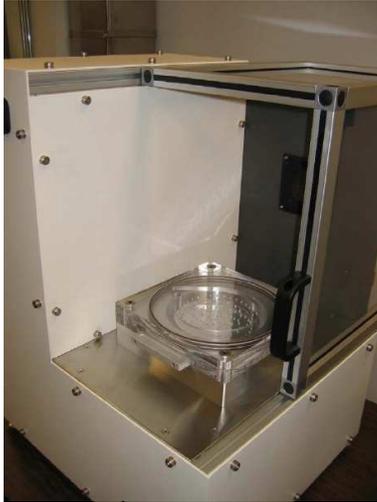


Figure 2.13

11. Carefully hold the microscope and adjust the height and rotation to prevent crashing with the lid and/or any shielding (Figure 2.14). Slide the extension arm until the objective lens is located on top of the sample (Figure 2.15).



Figure 2.14

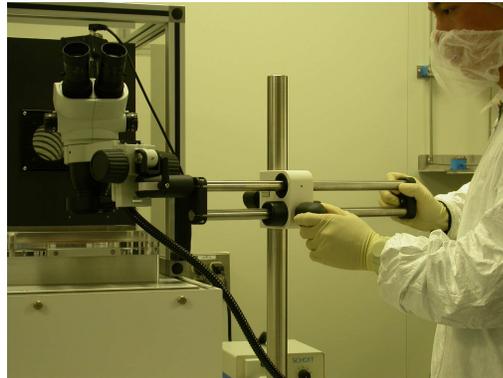


Figure 2.15

12. Switch on the illuminator and adjust the intensity (Figure 2.16)



Figure 2.16

- Click “**Image**” (Figure 2.17) and adjust the focus and magnification of the microscope (Figure 2.18) until a shape image is shown on the computer screen. Note that the user can switch between “**Setup**” and “**Image**” screen throughout the etching.

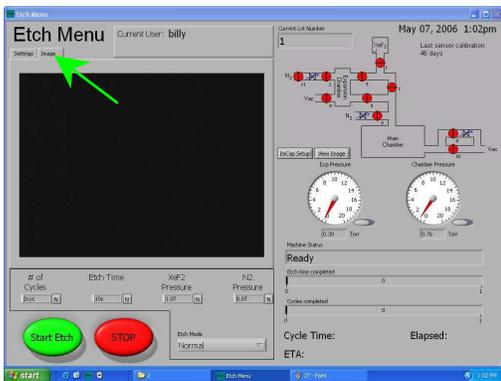


Figure 2.17



Figure 2.18

- Click on the “**ImCap Setup**” and “**View Image**” (Figure 2.19) to adjust the image quality and image capture properties (Figure 2.20).

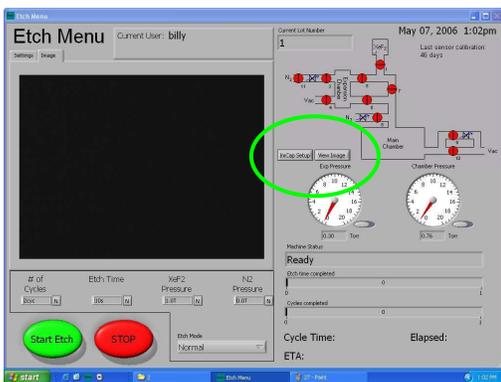


Figure 2.19

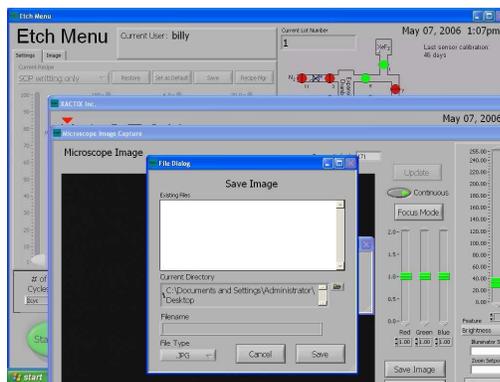


Figure 2.20

- When everything is ready, press “**Start Etch**”. Machine processing stage is shown in the “**Machine Status**” (Figure 2.21)

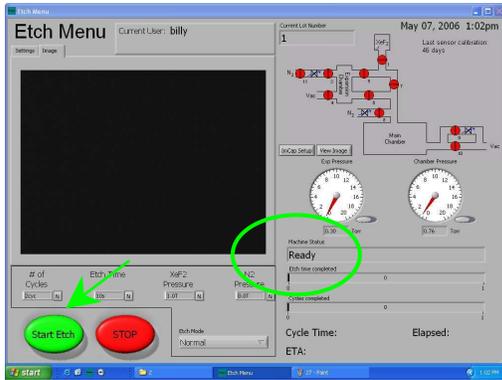


Figure 2.21

16. Changes to the number of etch cycles is possible while the sample is etching by using the “CHANGE CYCLE” button. (Figure 2.22)

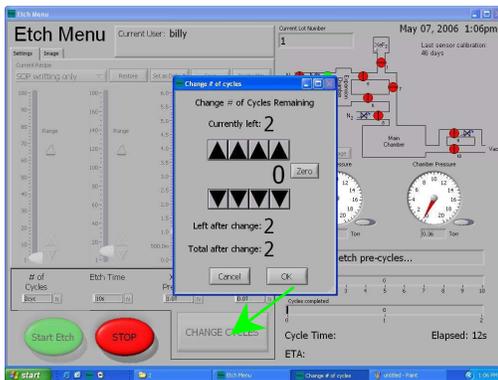


Figure 2.22

17. To change other parameters while etching, terminate the process by clicking “STOP” (Figure 2.23). Note that the machine will stop only after the current etching cycle is finished. Then, start from step 7 again once “Main menu “is prompted.

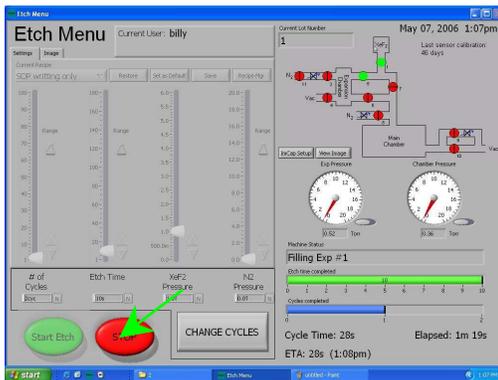


Figure 2.23

For example, if 2 cycles are pre-set and you need to change after “Start Etch” is clicked, Press “STOP” immediately. Then the machine will do 1 cycle of etching and then stop.

18. When the whole process is finished, main screen is returned. Before taking out the sample,

make sure the following procedures have been performed. (Figure 2.24)

- 1) Switch off the illuminator
- 2) Move the microscope carefully to its resting position with covering,
- 3) Pull the chamber ventilation shroud to the forward

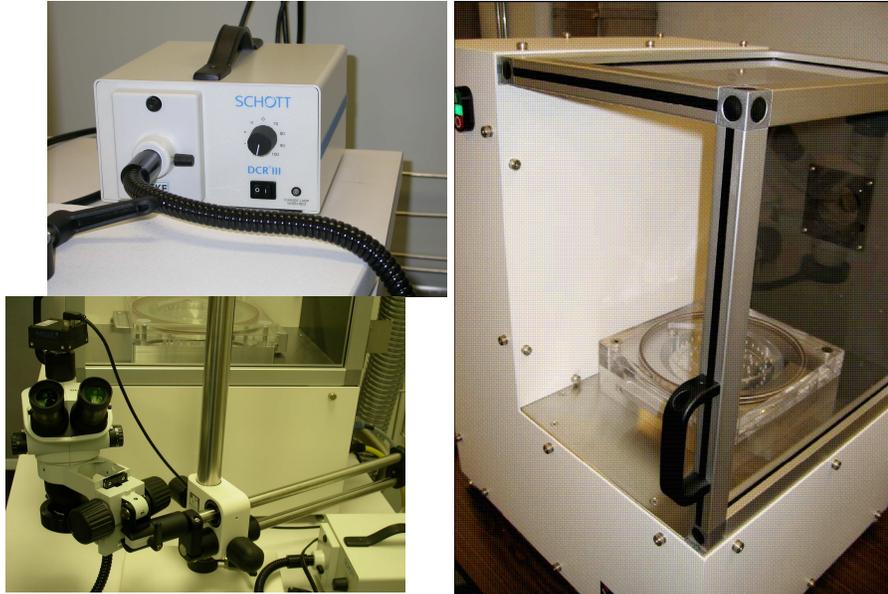


Figure 2.24

19. Click “Load/ Unload Sample” (Figure 2.25) with dialog box “Do you wish to load/change the sample” popped up. Click “Yes” to confirm. (Figure 2.26)

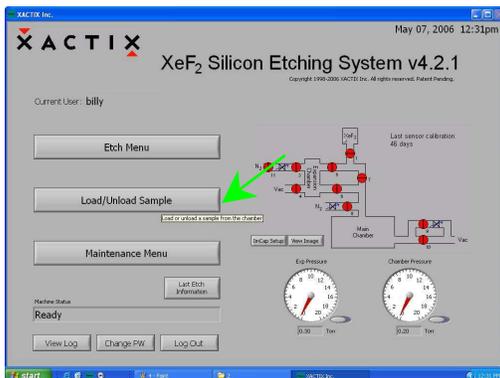


Figure 2.25

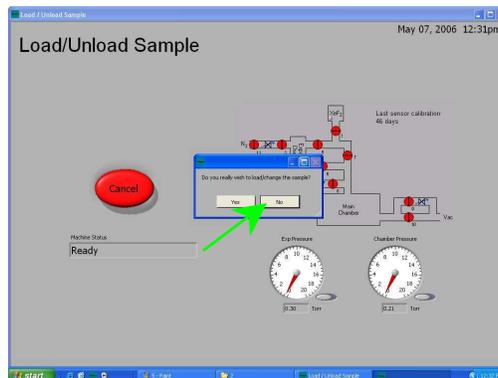


Figure 2.26

20. Open the chamber lip and take out the sample when “Waiting for user” is shown in the “Machine Status” (Figure 2.27) but don’t click any other button.

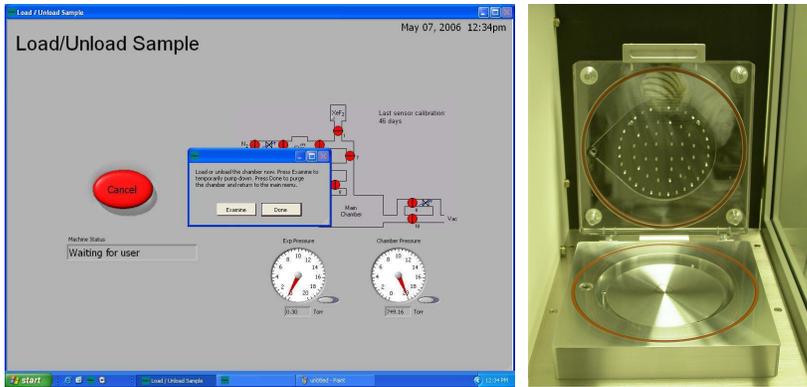


Figure 2.27

21. Before leaving, please do the following things

- 1) Check and place the black O ring back to the metal rack
- 2) Close the lid
- 3) Click “Done” in the pop up window to purge and pump down the chamber
- 4) Click Logout (Figure 2.28)
- 5) Write down the process in the log book (Figure 2.29)
- 6) Tidy up the machine area (including wiping down)

Note: users are not required to switch off the program and “DO NOT” switch off the machine

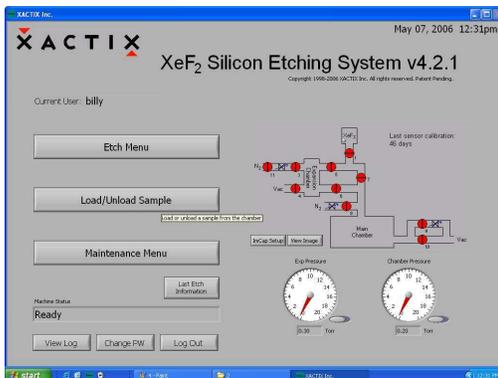


Figure 2.28

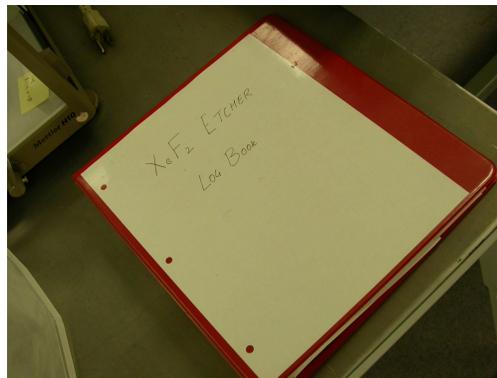


Figure 2.29

~End~