



Sentech Etchlab 200 Reactive Ion Etcher (RIE 2)

Standard Operating Procedure

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Overview

This document will provide a detailed operation procedure of the Fluorine-based Etchlab 200 Reactive Ion Etcher (RIE 2). Formal Training is required for all users prior to using the system.

Revision History

#	Revised by:	Date	Modification
1	Tom Cherng	Nov.1/09	Initial release
2	Nathanael Sieb	Nov.23/09	Formatting changes
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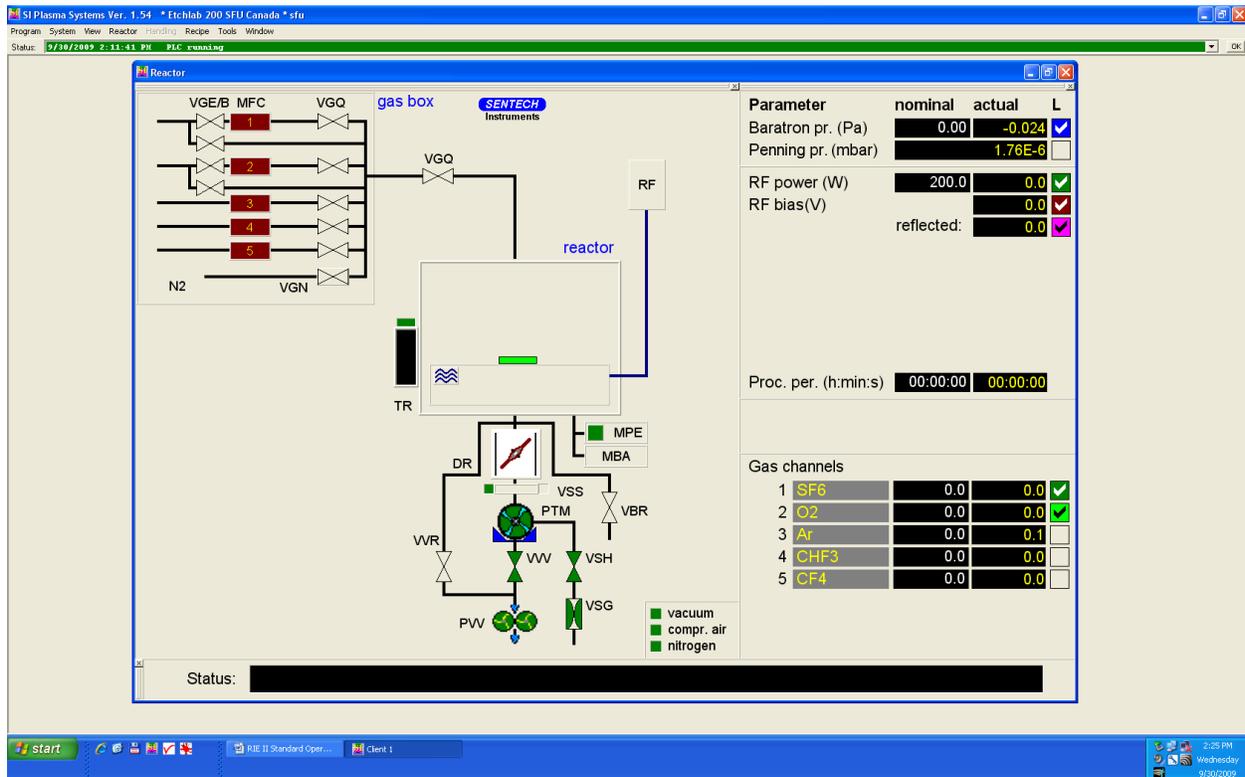
General Information

The fluorine-based Etchlab 200 RIE is equipped with the following gases: SF₆, O₂, Ar, CHF₃, and CF₄. This system is designed for etching silicon and silicon oxides.

Operation

1. System start and sample loading

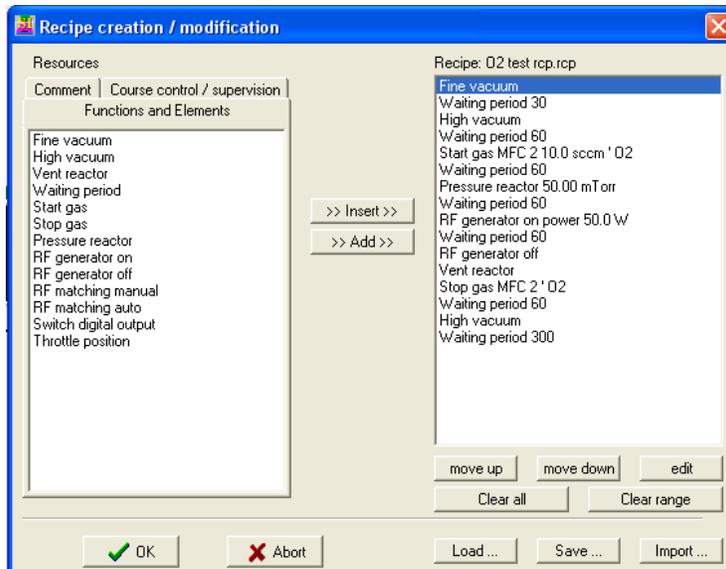
1. Turn on IGS SWITCH.
2. Turn on computer.
3. Log in as 4dlabs/4duser.
4. Double-click the "RIE2 Client" icon on the desktop to start the control program.
5. After the program starts, the main window appears on the screen.



6. The following elements are shown: menu bar; status bar for the whole system; reactor window; parameter window.
7. In the menu **Reactor** choose "Vent reactor". The status will show vent reactor as nitrogen is introduced into the chamber.
8. After ~30 sec., the status bar will show vent finished. Open the top cover of the reactor and load your sample on the center of the electrode. Close the top cover.
9. In the menu **Reactor** choose "High vacuum" to pump the reactor down to high vacuum.
10. The reactor status will show the high vacuum finished when the chamber reaches a low enough pressure.

2. Creating a recipe

1. In the **Recipe** menu choose "Create/Modify" or start the recipe editor with the button  when a recipe is already loaded.

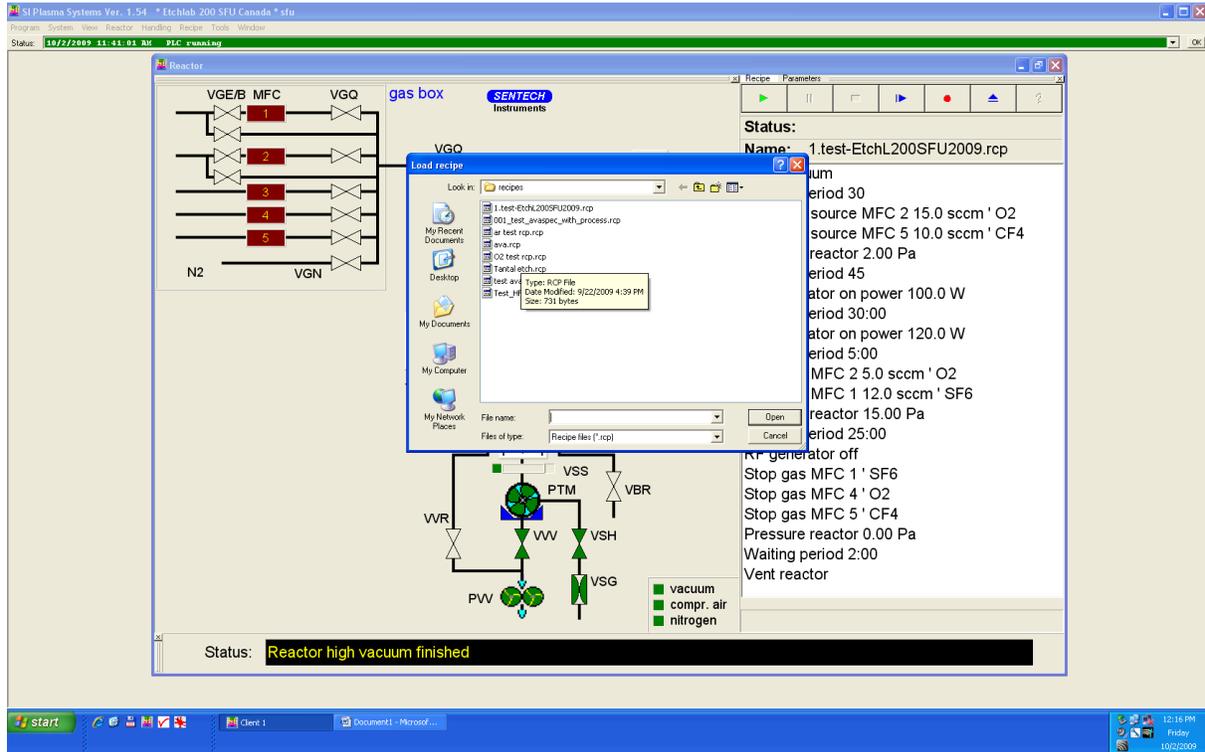


2. The Recipe editing dialog is shown. In the left side of the dialog all possible commands and options are displayed in tabs. The tabs consist of "Functions and Elements", "Course control/ supervision" and "Commands". The right side of the dialog shows the last recipe loaded. Click "Clear all" to clear the last recipe.

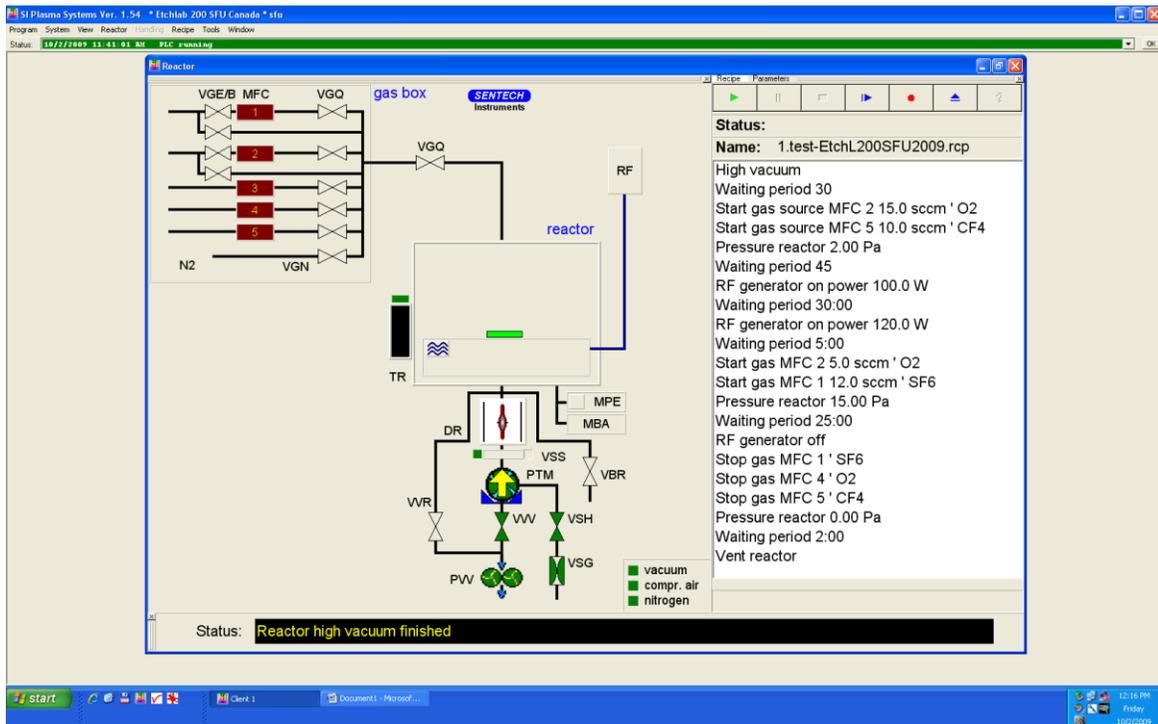
3. At the beginning choose on the left side of the dialog the tab **comment** and input a comment which describes the use of the recipe. Insert this comment in the recipe window by click the button **>> Insert >>**.
4. Open the tab Functions and Elements and select the functions which should be inserted in the recipe. These functions are copied to the recipe window after the last line with **>> Add >>** or before the selected line with **>> Insert >>**. The blue colored line is the actual line of the recipe.
5. According to the selected function/command a dialog opens in which more parameters have to be edited. Some of these dialogs include pressure, gas flow, RF power, and waiting period.
6. When the recipe is finished it can be saved by clicking **Save....**
7. An existing recipe can still be edited:
 - New functions can be inserted with **Insert** and **Add**.
 - Single lines can be deleted by clicking on the line and selecting **Clear range**. In the same way a range of lines can be deleted when more than one line is selected. Several lines can be marked with the SHIFT or CTRL key.
 - The sequence of the functions in the recipe can be changed with the buttons **move up** or **move down**. The lines can be positioned with the mouse by clicking with the right mouse button and dragging the line to the target position.
 - The parameters of the function can be changed with the button edit. The parameter dialogs will be shown on the screen.

3. Recipe operation

1. To load a recipe, click in the menu **Recipe** on the item "Load". Select the recipe file to be loaded.



2. When the recipe is loaded, the window for the recipe control in the reactor window is displayed.



3. In this window the whole recipe is displayed and the actual working status of the recipe is shown by a blue coloring of the actual command.
4. A loaded recipe can be started via the menu Recipe, or by clicking  in the control bar.
5. After starting the recipe, the menu bar and the buttons of the recipe control window change. In the menu bar the command "Cancel recipe" is added and in the recipe control window the buttons for stop and for canceling recipe are now accessible.
6. A recipe can be paused by clicking . The recipe is stopped immediately and can be continued at this point by clicking the button again.
7. A recipe can be stopped by clicking . With this command, the recipe cannot be finished. This command is only recommended for emergency since the reactor remains in the same configuration as the point that the recipe was stopped at.

4. Manual operation

1. In the **Reactor** window, click the right-side **VGQ** to open the main gas inlet valve, then click the left-side **VGQ** valve next to the MFC. The process gases for RIE 2 are listed under Gas channels in the **parameter** window.
2. If gas 1 or gas 2 are used for the process, you must click **VGEB** to open the valve before the MFC.
3. In the Parameter window the nominal values and the actual values of the process parameters are displayed. The first column displays the name of single parameters, the second column shows the nominal values, and the third column displays the actual values.
4. In the Gas channel listing, click the second column of the process gas you chose. Input the desired flow rate and press return. (the units are sccm) The third column will display the actual gas flow rate.
5. Click the nominal column of the Baratron pr., input the process pressure value (mtorr), and press enter.
6. Input the desired RF power and process time in a similar manner.

7. In the reactor window, click the  icon to turn on the reactor cooling water. The color of the substrate electrode will change to blue.
8. Wait for the pressure to equilibrate.
9. Click the **RF** icon to turn on the RF power.
10. The plasma will be generated (look in the chamber) and the actual column of Proc. per. begins to count up the process time.
11. The RF power turns off after the actual time reaches the process time.
12. Click the left-side **VGQ** of the MFC to close the process gas valve and then click the right-side **VGQ** to close the main gas inlet valve.
13. Reset the nominal value of all process gases to 0.
14. Reset the reactor pressure to 0.
15. Wait 2 minutes to allow all residual gases to evacuate.

5. Sample unloading

1. In the menu **Reactor** choose "Vent reactor".
2. After Vent reactor is finished (~30 sec), open the top cover and remove your sample.
3. Close the reactor top cover. In the menu **Reactor** choose "High vacuum" to pump the reactor down to high vacuum.
4. Leave the system under vacuum at the end of use.

References and Files

Etchlab 200 Manual and RIE 2 training notes.

Contact Information

Questions or comments in regard to this document should be directed towards Tom Cherng (cherng@4dlabs.ca) in 4D LABS at Simon Fraser University, Burnaby, BC, Canada.