



NEXX Systems Cirrus 150 ECR PECVD System Operating Procedure

Standard Operating Procedure

4D Labs Confidential

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Revision History

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Table of Contents

1	Purpose	4
2	Definitions & Document Conventions	4
2.1	Definitions	4
2.2	Conventions	4
3	References.....	5
4	Contact	5
5	Hazards.....	6
6	ECR PECVD System.....	7
6.1	Overview	7
6.2	Substrates.....	8
6.3	Deposition	8
6.3.1	Recipes	8
6.3.2	Process Chamber Conditioning	8
6.3.3	Substrate Cooling.....	9
7	Procedure	10
7.1	Reserving the PECVD System.....	10
7.2	Checking the System Prior to Deposition.....	10
7.3	Logging In	12
7.4	Mounting Substrates on Carriers	12
7.5	Substrate Loading.....	13
7.6	Deposition	14



8	Recipes.....	19
8.1	Introduction.....	19
8.2	Recipe Creation & Modification.....	19
8.3	Backing Up Recipes.....	21
8.4	Deleting, Copying, & Renaming Recipes.....	21
9	User Data.....	22



1 Purpose

This document describes how to operate the NEXX Systems Cirrus 150 ECR PECVD System in the 4D Labs Nanofabrication Facility. It is intended to be a reference for trained users of the system and is **not** a substitute for training by Nanofabrication Facility staff. In addition, operators of the system are expected to have a basic familiarity with high vacuum systems.

2 Definitions & Document Conventions

2.1 Definitions

a-Si: amorphous Silicon

CVD: Chemical Vapour Deposition

ECR: Electron Cyclotron Resonance. A method for generating a high density plasma.

LL: Load Lock chamber. Vacuum chamber into which substrates are placed for transfer into the process chamber.

PC: Process Chamber. Vacuum chamber in which film deposition takes place.

PECVD: Plasma Enhanced Chemical Vapour Deposition

TMP: Turbomolecular Pump

TPU: Thermal Processing Unit. The TPU burns hazardous exhaust gasses from the PECVD system and sends the combustion products to an acid waste neutralization system.

2.2 Conventions

In this document, software and hardware buttons are underlined. The names of software menu items & windows and hardware components are italicized.



Hazards:

- **WARNING** denotes a hazard which may result in harm to a person and, perhaps, property damage.
- **CAUTION** denotes a hazard which may result in property damage only.

3 References

- NEXX Systems, Inc., Cirrus 150 High Density Plasma Processing System Product Specification, Rev. 1.0/011603.
- NEXX Systems, Inc., Cirrus 150 High Performance Plasma Processing System Maintenance Engineers' Manual.
- NEXX Systems, Inc., Cirrus 150 Training Outline.

4 Contact

Questions or comments concerning this document or operation of the system should be directed to the tool owner, Philip Kubik (Kubik@4DLabs.ca), 4D Labs Nanofabrication Facility, Simon Fraser University, Burnaby, BC, Canada.

5 Hazards

WARNING

The PECVD system uses hazardous gasses. In particular, SiH_4 is pyrophoric.

- 1) Always allow safety purges to run their full course.
- 2) The **green** *Exhaust to Combustor* lamp on the *TPU-PECVD Interface Module* must be lighted when CF_4 & SiH_4 are flowing. If the *Exhaust to Combustor* lamp is off, do not proceed with deposition. Instead, inform the tool owner.
- 3) The **yellow** *TPU Warning* lamp indicates a problem in the TPU, which may cause PECVD gas flows to shut off. If the *TPU Warning* lamp comes on, do not start a deposition recipe. If the lamp comes on while running a recipe, you may continue but be aware that it may abort suddenly and without warning.

WARNING

A high static magnetic field surrounds the process chamber. Mechanical forces exerted by the magnetic field on ferromagnetic tools and medical implants may be hazardous. **Individuals having implanted cardiac pacemakers or defibrillators must not approach within 2 m of the process chamber.**¹ The magnetic field may also erase magnetically recorded data, e.g., credit cards, floppy disks, USB drives.

WARNING

Substrates and substrate carriers in the load lock chamber may be hot. Approach them with caution.

¹ For details of the magnetic fields associated with the PECVD system, see:

NEXX Systems, Inc., Cirrus I50 High Performance Plasma Processing System Maintenance Engineers' Manual, Section 7.4.

6 ECR PECVD System

6.1 Overview

The NEXX Systems Cirrus 150 ECR PECVD system is capable of depositing thin, low stress SiO_2 , Si_3N_4 , SiO_xN_y , and amorphous silicon (a-Si) films at substrate temperatures $< 90^\circ\text{C}$. A high ion current density at the substrate surface promotes conformal, uniform films without requiring additional thermal activation. However, since the ions have low energy, surface damage is mitigated. For Si_3N_4 and SiO_xN_y films, the remote high density ECR plasma allows the use of N_2 as a nitrogen source, instead of NH_3 , reducing the H content of the films compared to conventional RF PECVD.

Features:

- Conformal SiO_2 , Si_3N_4 , SiO_xN_y , and amorphous silicon (a-Si) film deposition.
- Film stress control.
- Substrates from chips to 150 mm diameter wafers.
- Substrate cooling keeps substrate temperatures $< 90^\circ\text{C}$ during deposition.²
- SiO_2 deposition rates up to ~ 20 nm/min.
- Load lock chamber helps maintain a 2×10^{-7} Torr process chamber base pressure and reduces potential exposure to hazardous gasses.
- Recipe-based deposition.
- Automatic safety purges.

² Currently, the substrate chuck cooling water is configured for a temperature of 18°C but substrate heating during deposition raises the substrate temperature. Substrate chuck coolant temperatures ranging from -15°C to 80°C are possible. If a coolant temperature other than 18°C is desired, consult the tool owner.



- Process gasses: Ar, N₂, O₂, SiH₄, & CF₄ (for chamber cleaning).

6.2 *Substrates*

- 150 mm diameter wafers or smaller substrates on 150 mm diameter carriers.
- Carriers for 2" wafers, 100 mm wafers, and irregular substrates are provided
- Maximum thickness of the **substrate and carrier** is about 12 mm. Substrates thicker than 2 mm will require a custom carrier; consult the tool owner.

6.3 *Deposition*

6.3.1 *Recipes*

Film deposition in the PECVD system is accomplished exclusively by running recipes. **Only run your own recipes**, which must be identified as yours by placing your initials at the beginning of the file name and your name in the recipe description. **Any change that you make to a recipe is saved immediately and automatically, without a prompt to save.**

6.3.2 *Process Chamber Conditioning*

In order to get reproducible films, it is important that the process chamber and substrate carrier be conditioned prior to deposition onto your substrates. To condition the process chamber and carrier, deposit 200 nm of the desired film onto a dummy wafer. Dummy 150 mm, 100 mm, and 2 inch wafers are provided by 4D Labs for this purpose. Dummy wafers may be reused for multiple depositions. After use, be sure to return dummy wafers to their containers. If you plan to do several runs of the same film in a single day, it is sufficient to do one dummy run initially. Preferably, the parameters of the conditioning run will be identical to those that you will use for your substrate, except, perhaps, for the duration of the deposition.

6.3.3 Substrate Cooling

Despite the fact that there is no substrate heater in the PECVD system, substrates are subject to heating during the deposition process. To mitigate this effect, substrates are cooled by:

- 1) Flowing chilled water through the wafer chuck.³
- 2) Clamping the substrate carrier or 150 mm wafer to the chuck electrostatically.
- 3) Employing He gas to improve thermal conduction between the wafer chuck and substrate and/or substrate carrier.

The latter method is denoted backside He cooling. Whole wafers (150 mm, 100 mm, & 2") mounted on a corresponding wafer carrier are cooled directly by the He gas. The chip carrier is directly cooled by He gas but substrates on it are indirectly cooled by clamping them to the carrier; this is not as effective as direct cooling of the substrate. A backside He mass flow controller attempts to maintain a constant backside He gas pressure. Cooling may be improved by increasing the pressure but the He gas pressure should not be allowed to exceed the electrostatic clamping pressure. Otherwise, electrostatic clamping will fail and there will be a dramatic increase in the He gas flow. He gas flow and pressure and substrate temperature will all become unstable and film reproducibility may be compromised. Consequently, a maximum backside He pressure of 3 Torr is recommended for all substrate carriers. Substrate temperature during deposition may be raised by reducing the backside He gas pressure. Alternatively, for 150 mm wafers and some substrate carriers, it may be possible to reduce substrate temperature by increasing the backside He pressure above 3 Torr; consult the tool owner if this is desired.

The seal between the substrate (or carrier) and wafer chuck relies on the surfaces being clean and flat and there is always some leakage, which is measured by the backside He flowmeter. Normally, leakage should be below 5 sccm but He leakage could be increased, for example, by:

- Failure of electrostatic clamping.

³ Currently, the substrate chuck cooling water is set to a temperature of 18°C but temperatures ranging from -15°C to 80°C are possible. If a coolant temperature other than 18°C is desired, consult the tool owner.



- Particles between the wafer and substrate carrier or between the substrate carrier and chuck.
- Poor clamping of the wafer to the wafer carrier.
- Not pumping out the backside He line after turning on the electrostatic chuck.⁴

7 Procedure

7.1 Reserving the PECVD System

Prior to use, reserve the PECVD system through the Nanofab Booking web site (<https://nanofabrication.4dlabs.ca>), even if you wish to use the system immediately.

7.2 Checking the System Prior to Deposition

WARNING

A high static magnetic field surrounds the process chamber. Mechanical forces exerted by the magnetic field on ferromagnetic tools and medical implants may be hazardous. **Individuals having implanted cardiac pacemakers or defibrillators must not approach within 2 m of the process chamber.**⁵ The magnetic field may also erase magnetically recorded data, e.g., credit cards, floppy disks, USB drives.

Before loading your substrates, do the following.

- 1) Observe the indicator lamps on the *TPU-PECVD Interface Module*. The **green Exhaust to Combustor** lamp should be **on** and the **yellow TPU Warning** lamp should be **off**. Otherwise, do not proceed. Instead, contact the tool owner and make a note in the log book.

⁴ The Cirrus software is configured to perform this action prior to the first step in each recipe.

⁵ For details of the magnetic fields associated with the PECVD system, see:

NEXX Systems, Inc., Cirrus I50 High Performance Plasma Processing System Maintenance Engineers' Manual, Section 7.4.

- 2) Check the computer monitor for error messages or alarms.⁶ If there are any errors or alarms, do not proceed. Instead, report the issue to the tool owner and make a note of the issue in the log book along with the date and time, your name, and any other relevant information.
- 3) Check the following on the system schematic displayed on the computer monitor. If any item is not as specified, do not proceed with deposition. Instead, report the problem to the tool owner and make a note in the log book.
 - a) All gas line valves on the left side Closed (white fill)
 - b) *He Relief Valve* Closed (white fill)
 - c) *PC Backing Pump* icon Green
 - d) PC foreline pressure < 100 mTorr
 - e) PC foreline valve Open (black fill)
 - f) *Turbo Pump* icon Green
 - g) *Throttle Valve* Open 100%⁷
 - h) PC wide range gauge valve Open (black fill)
 - i) PC–LL gate valve Closed (black bar above green bar)
 - j) *LL Backfill Valve* Closed (white fill)
 - k) *LL Purge Valve* Open (black fill)
 - l) *LL Roughing Valve* Open (black fill)
 - m) LL pressure $\cong 2 \times 10^{-1}$ Torr

⁶ Normally, the Cirrus 150 software should be running. If the monitor is black, momentarily press the Shift key on the computer keyboard and wait about 10 s; the monitor should awaken.

⁷ Unlike all other valves, the *Throttle Valve* icon always has black fill, even when closed. The % open value under the valve indicates how much it is open.



- n) PC wide range gauge pressure $\leq 5 \times 10^{-6}$ Torr
- 4) Check the *PECVD Log Book* for any relevant information.⁸
- 5) Sign in on the *PECVD Run Log Sheet*. Enter the expected film thickness.

7.3 Logging In

You must log in to the Cirrus 150 software before operating the PECVD system. Log in as follows.

- 1) Press the Operator button at the top of the Cirrus 150 screen, using the monitor pen.
- 2) In the log in window, press Log On.
- 3) Enter your user ID and password.
- 4) Press OK.
- 5) Close the log in window.

7.4 Mounting Substrates on Carriers

150 mm wafers may be placed directly on the transfer arm in the LL. Substrates of other sizes should be mounted on one of the substrate carriers provided and the carrier placed on the transfer arm. Substrate carriers are anodized so handle carefully in order to avoid scratching the surface. Place substrate carriers on soft surfaces only, e.g., tissues or plastic.

Cooling of 2 inch & 100 mm wafers is improved if they are mounted on their respective wafer carriers, rather than the chip carrier. When mounting wafers on the 2 inch or 100 mm wafer carriers, align the wafers to the o-rings and the clamping ring recess carefully.

⁸ Normally, it is unnecessary to sign into the *PECVD Log Book*; however, you should make an entry into the log book if you encounter errors, unexpected behaviour, system malfunction, or you wish to make comments for the benefit of the tool owner, yourself, or other users. If you observe an error message or alarm, record the date and time, your name, a brief description of the error or alarm, and any other relevant information in the log book.



Always use a **full** complement of **vented** 4-40 x ¼" screws on substrate carriers with o-ring seals.⁹ On the 2 inch single wafer carrier, socket head cap screws are recommended because the button head screws bind. On the other carriers, use button head screws. Tighten the screws gently and incrementally in a star pattern until they are lightly snug. Excessive or non-uniform force or poor alignment may cause wafers to crack or chip. If any screw binds in the 100 mm wafer or chip carriers, inform the tool owner & note the specific problematic holes in the log book. Screws may bind a little in the 2" wafer carriers because they contain Heli-coil inserts. Severe binding should be reported to the tool owner.

7.5 Substrate Loading

WARNING

A high static magnetic field surrounds the process chamber. Mechanical forces exerted by the magnetic field on ferromagnetic tools and medical implants may be hazardous. **Individuals having implanted cardiac pacemakers or defibrillators must not approach within 2 m of the process chamber.**¹⁰ The magnetic field may also erase magnetically recorded data, e.g., credit cards, floppy disks, USB drives.

Load substrates as follows.

- 1) Observe whether there are substrates and/or a substrate carrier in either the load lock (LL) or process chamber (PC). There should be a flashlight in the PECVD tool cabinet.
 - a) If the LL & PC are both empty, proceed to step 2).
 - b) If the either contains a substrate or substrate carrier, contact the previous user or the tool owner before proceeding.

⁹ 8 screws for 100 mm wafer carriers & 6 screws for 2 inch wafer carriers.

¹⁰ For details of the magnetic fields associated with the PECVD system, see:

NEXX Systems, Inc., Cirrus I50 High Performance Plasma Processing System Maintenance Engineers' Manual, Section 7.4.



- 2) If the load lock is **not** at atmospheric pressure, vent it as follows. Otherwise, proceed to step 3).
 - a) Press the Run mode button to open the *Run* screen.
 - b) On the right pane of the *Run* screen, press LL→ATM.
 - c) Wait (2-3 min) for the message "LL @ Atmosphere" to appear above the LL in the system schematic shown on the monitor and in the *Status* bar.
- 3) Open the LL door.
- 4) Place your 150 mm wafer or substrate carrier with substrates onto the transfer arm, with the major flat on the right.
- 5) Close the LL door.
- 6) On the right pane of the *Run* screen, press Load. You will be prompted to check that there are no substrates on the wafer chuck.
- 7) After your wafer has been transferred onto the wafer chuck, the electrostatic chuck will apply 400 V to clamp the wafer and the electrostatic chuck window will open. Drag it to a convenient location with the light pen.

7.6 Deposition

This section describes how to run a deposition recipe. Here, it is assumed that you have already created a recipe. Recipe creation and modification is discussed in Section 8: [Recipes](#).

Only run your own recipes, which must be identified as yours by placing your initials at the beginning of the file name and your name in the recipe description.

- 1) Turn on the *Astex 2115 1500 W Microwave Power Generator* as follows.
 - a) Flip up the breaker on the front of the unit.
 - b) Wait for the Ready button to illuminate, indicating *Local* control.
 - c) Press the Ready Button. The *Local* control lamp should go off, indicating *Remote* control.

- d) On the computer monitor, click the Microwave button. The *Microwave* window should open.
 - e) Ensure that the *Remote & Ready* check boxes in the *Microwave* window are checked.
 - f) Move the *Microwave* window to a convenient location on the monitor.
- 2) On the computer monitor, press the Edit mode button to open the *Recipe Editor* window.
 - 3) The current recipe is displayed to the right of the Recipe button. Select one of your recipes as follows.
 - a) Press Recipe.
 - b) Select the desired recipe from the drop down list.
 - c) Press OK.
 - 4) Ensure that the recipe is correct. All recipe steps will be run in ascending sequence (from step 1) until a step with *Step Processing Time* = 0 is encountered.
 - 5) You may change the duration of the deposition step(s) as follows. Other recipe parameters may be changed in a similar manner. **Any change to a recipe is saved immediately and automatically, without any prompt to save.**
 - a) Move the deposition step to be edited to the leftmost column, using >>>> and <<<<, if necessary.
 - b) Press Step Processing Time.
 - c) Enter the desired duration of the step in seconds.
 - d) Press OK.
 - e) Move Step 1 to the leftmost column, using <<<<.
 - 6) Data logging is enabled (recommended) or disabled for each step individually as follows.
 - a) Press Datalog on the toolbar at the top of the *Recipe Editor* window to open the data logging window.
 - b) For each recipe step,
 - i) Either enable or disable data logging.

- ii) If data logging is enabled, set the sampling time interval.
 - iii) Press OK.
- 7) Close the *Recipe Editor* window by pressing Close Editor on the toolbar.
 - 8) Enter *Run* mode by pressing Run.
 - 9) Check that the desired recipe is shown in the green *Run Mode Information* window at the bottom right of the monitor.¹¹
 - 10) Wait until PC wide range gauge pressure $\leq 1 \times 10^{-5}$ Torr before starting a deposition recipe.
 - 11) To start the recipe, press Start on the right pane. The *Loading Options* window should open.
 - 12) Select the desired loading option, depending on the location of your substrate.
 - 13) Look at the green *Run Mode Information* window at the bottom right. Observe whether the *Tolerance Checking & Data Logging* check boxes are correct.
 - 14) After the plasma has ignited, check that:
 - a) The plasma is stable.
 - b) Microwave reflected power < 10% forward power.
 - c) Gas flows and process chamber pressure are close to setpoints.
 - d) ESC voltage is approximately 400 V and current should be zero (upper limit is 2 mA).
 - e) Backside He flow < 10 sccm but preferably < 5 sccm.¹²
 - 15) At any time, if you wish to abort a recipe, press either of the following buttons on the right pane of the *Run* screen.

¹¹ Data logging and tolerance checking will be shown to be off, even if they were turned on in the recipe. The correct state of these features for the active step is not displayed until the recipe begins.

¹² Cf. Section 6.3.3: Substrate Cooling.



- a) End Step: Ends the current step immediately and proceeds to the next step. At the end of the recipe, a safety purge is performed, as usual.
 - b) Stop: Ends the recipe immediately. **No safety purge is performed.** If any hazardous gasses have flowed, a safety purge must be performed manually, e.g., by running another recipe such as 4D_AR01.rcp.¹³ If a safety purge cannot be performed, inform the tool owner and make a note in the log book.
- 16) At the end of the recipe, a safety purge is performed. Allow the purge to run its full course.
- 17) If data logging was turned on, you will be prompted to save the data log file. The proposed file name is that of the last file saved so, in general, you should modify it. Your data log files should begin with your initials in order to identify them as yours. The Cirrus software only recognizes file names of up to 8 characters, excluding the extension.
- 18) You will be prompted to transfer your substrate to the LL. If you select No, you may transfer later by using the Unload button on the right pane of the *Run* mode screen.
- 19) If you elected to transfer your substrate(s) to the LL, you will be prompted to vent the LL to atmospheric pressure.
- a) If you select Yes, wait (2-3 min) for the message "LL @ Atmosphere" to appear above the LL in the system schematic shown on the monitor and in the *Status* bar.
 - b) If you select No, you may vent the LL later by using the LL→ATM button on the right pane of the *Run* mode screen.
- 20) When the LL is at atmospheric pressure, you may open the LL door and remove the substrate carrier and substrates.

WARNING

Substrates and substrate carriers in the load lock chamber may be hot. Approach them with caution.

¹³ 4D_AR01.rcp flows Ar for 20 s. At the end, a safety purge is performed.



- 21) After removing your substrate(s),
 - a) Close the LL door.
 - b) Press Pump Down LL on the right pane of the *Run* mode screen.
- 22) If you have completed your depositions for the day, turn off the *Astex 2115 1500 W Microwave Power Generator* by flipping down the breaker on the front of the unit.
- 23) When you are finished, log off from the Cirrus software but do **not** exit.
- 24) Move your data log files to your own folder in the My Documents directory and, if desired, copy them and your recipes to a 3 ½" floppy disk.
 - a) Open Windows Explorer without exiting from the Cirrus software, e.g., by pressing the Windows-d key combination on the keyboard.
 - b) Navigate to the *C:\Logdata* directory.
 - c) Press Name at the top of the Windows Explorer column to sort the files by file name.
 - d) If you have named your recipes as recommended, they should be grouped together.
 - e) Copy and paste the desired file(s) to your folder in *My Documents* and/or your floppy disk.
 - f) You may also wish to cut & paste your data log files into your own folder within the *C:\Logdata* directory.
 - g) Close all Windows Explorer windows.
 - h) Activate the Cirrus software.



8 Recipes

8.1 Introduction

Users may run only their own recipes. Since all recipes must be located in the same directory (*C:\Windows*), identify your recipes by placing your initials at the beginning of the file name. Also, include your full name in the recipe description, which is displayed in the *Recipe Editor* window. 4D Labs recipes are identified by "4D" at the beginning of the file name. They are provided as templates from which users may create their own recipes. In order to preserve the integrity of 4D Labs recipes, do **not** modify them.

8.2 Recipe Creation & Modification

To create a new recipe or modify an existing recipe, press the Edit mode button in the Cirrus software; the *Recipe Editor* window should open. The file name of the current recipe is displayed to the right of the Recipe button and the recipe description is shown in the box to the right of that. Below, the left pane contains a column of recipe parameter buttons. In the right pane, under the description box, are the current values for each parameter in each step of the recipe. Pressing a parameter button opens a window in which the value of the parameter in the current step can be changed. The current step is the leftmost step displayed in the right pane. The current step can be changed using the <<<< and >>>> buttons at the bottom of the left pane. Any changes are saved immediately and automatically, without prompting you to save.

All of the steps in a recipe will be run in ascending sequence, starting with Step 1, until a step with a Step Processing Time equal to 0 is encountered. No steps with higher numbers will be run even if Step Processing Time is non-zero.

To select a recipe for editing:

- 1) Press the Recipe button at the top of the left pane.
- 2) Select the desired recipe from the drop-down list.
- 3) Press OK.



To create a new recipe:

- 1) Press the New Recipe button in the *Recipe Editor* toolbar (across the top of the window).
- 2) When prompted, enter a file name. The Cirrus software only recognizes file names of up to 8 characters, excluding the .rcp extension.
- 3) Press OK.

To change parameter values in the current recipe:

- 1) Make the step to be edited the current step by moving it to the leftmost position using the <<<< and >>>> buttons at the bottom of the left pane.
- 2) To change the value of a parameter, click the corresponding button on the left pane and enter the desired values in the parameter window.
- 3) When finished, press OK.

To enable data logging in the current recipe (recommended):

- 1) Press the Datalog button in the *Recipe Editor* toolbar. The data logging window should open.
- 2) In the data logging window:
 - a) Select a recipe step to be logged.
 - b) Enter *Yes* or *No* to enable or disable data logging for the step.
 - c) If data logging is enabled, enter the sampling time interval.
 - d) Press OK.
- 3) Repeat step 2) for all recipe steps.

Entire steps may be copied, pasted, inserted, cleared, added, & deleted by using the corresponding buttons in the *Recipe Editor* toolbar. After pressing one of these buttons, a dialogue box opens, which allows one to select the step to be acted upon. The button names are self-explanatory. Add Step inserts a new step after the last recipe step. It is possible to copy a step from one recipe and paste it into another but only one



step at a time. When creating a new recipe, it is usually simplest to copy steps from a similar existing recipe.

When finished editing, close the *Recipe Editor* window by pressing Close Editor in the *Recipe Editor* toolbar.

8.3 Backing Up Recipes

Your recipes will not normally be backed up unless you do it yourself. Place backup copies of your recipes in your folder in the My Documents directory and/or on a 3 1/2" floppy disk as follows.

- 1) Open Windows Explorer without exiting from the Cirrus software, e.g., by pressing the Windows-d key combination on the keyboard.
- 2) Navigate to the *C:\Windows* directory.
- 3) Press the Name column heading in Windows Explorer to sort the files by filename.
- 4) Scroll to your initials to find your recipes.¹⁴
- 5) Copy and paste the desired file(s) to your folder in *My Documents* and/or your floppy disk.
- 6) Close all Windows Explorer windows.
- 7) Make the Cirrus software active.

8.4 Deleting, Copying, & Renaming Recipes

Recipes cannot be deleted or renamed from within *Recipe Editor*. Neither can an entire recipe be copied in a single step from within *Recipe Editor*. As one would expect, these actions can be accomplished from Windows Explorer but, unless one exits from the Cirrus software first, the changes will not be recognized

¹⁴ If you did not consistently put your initials at the beginning of your recipe filenames (naughty, naughty), press the Type column heading in Windows Explorer and scroll down to the *.RCP* files to find your recipes.



by the Cirrus software. If one exits from the Cirrus software, any processes will be terminated and all gas line valves will be closed. However, the pumps will remain on and the vacuum line valves will remain open.

- 1) To exit from the Cirrus software,
 - a) Check the *Status* bar and **ensure that no processes are running**.
 - b) Press the Status mode button.
 - c) Press the red Exit button at the bottom right of the *Status* window.
 - d) Confirm that you wish to exit from the Cirrus software.
- 2) When you have finished manipulating your recipes, restart the Cirrus software by double clicking the NEXX icon on the desktop. Ensure that the Cirrus software starts properly before you leave.

9 User Data

There is significant risk that you or other users may inadvertently modify, delete, or completely overwrite your recipes or data logs. Consequently, you are strongly advised to copy your recipe and data log files on to your own 3 ½" floppy disk and/or to your folder in the My Documents directory. User data will be backed up sporadically by the tool owner but you should not rely on this. USB devices, CD-Rs, and DVDs are not compatible with the PECVD computer ☹.

Recipe files have an .RCP extension and are located in the *C:\Windows* directory. Do not create your own sub-directory for your files because the Cirrus software will not find them. If you rename, copy, or delete any recipe files from within Windows Explorer, those changes will not be recognized by the Cirrus software, unless you exit from it first and then, after making the changes to the files, you restart the Cirrus software (cf. Section 8.4: Deleting, Copying, & Renaming Recipes).

Data log files have a .txt extension and are located in the *C:\Logdata* directory. If you wish, you may create your own sub-directory to store your log files.