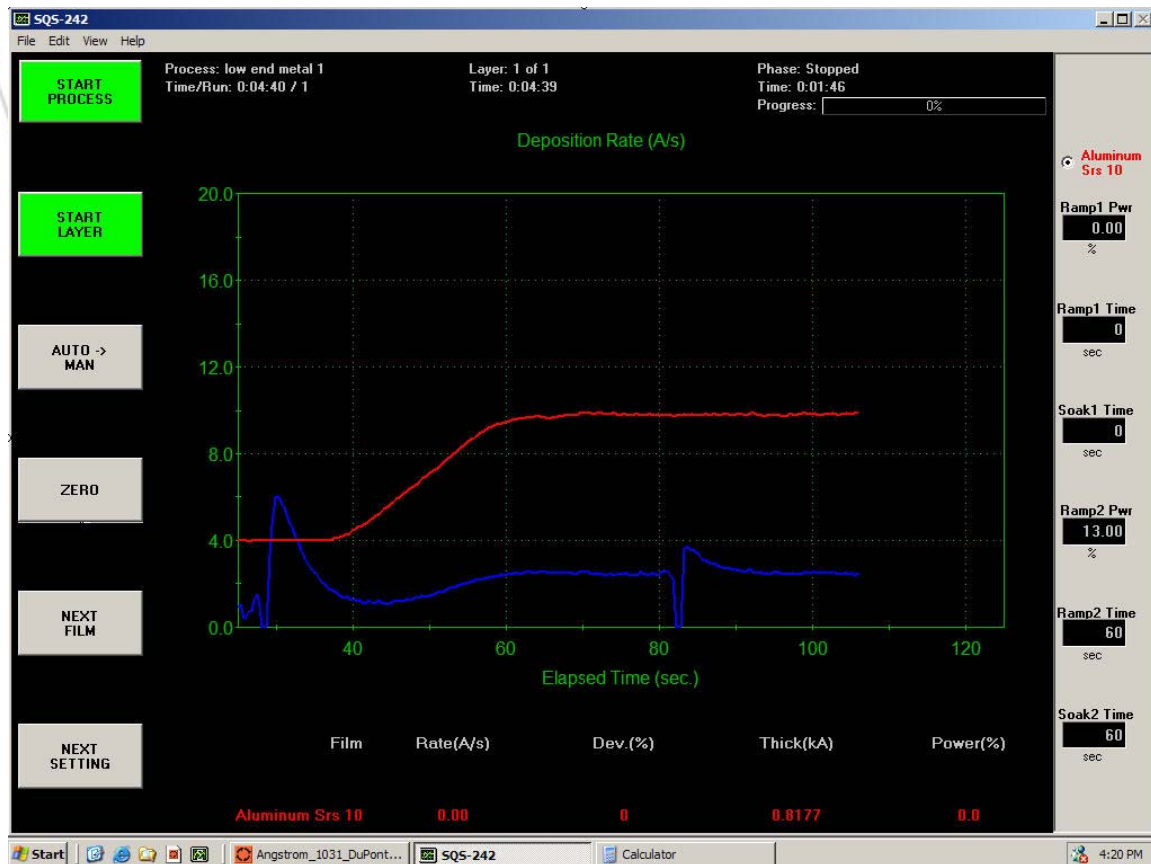


Chapter 4 – Depositing Materials

Deposition control is accomplished using the Inficon SQS-242 deposition software, which is windows based and controls a PCI card mounted in the system PC. The card has two control outputs and four rate monitor inputs. The deposition control software communicates to the PLC through the PC using a serial cable. This system utilizes two control outputs and two sensor inputs.



This system is equipped with a Telemark six pocket electron beam source with 7 cc pockets and 2 resistive sources. Output 1 from the Inficon deposition control software is connected to and controls the six pocket electron beam source. Output 2 is connected to and controls the resistive sources 2 and 3.

Two Quartz crystal monitors (sensors) for rate control monitor the control outputs. Sensor 1 monitors deposition rate from source 1, sensor 2 monitors deposition rate from source 2 and source 3. Co-deposition is possible between source 1 and source 2 or source 1 and source 3.

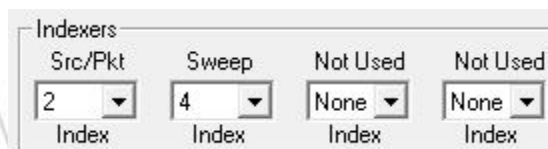
The Inficon deposition control software is provided with a detailed manual. An electronic copy of this manual is enclosed in the appendix of this manual. More information on how the Inficon software is set up and operated on this system can be found in the Inficon SQS-242 Deposition Control Software manual in the System components section of this manual, or the Inficon Control Software System Settings section in the Appendix of this manual.

When the Inficon software is opened, the program goes through a number of diagnostics and then presents a user login window. Unless the user has changed the password, hit enter or click on ok to clear the window, and the program is ready to use. The ability of the software to start a deposition is controlled by the SCADA software and the PLC. If any of the interlocks on the left side of the system interlocks page are not met the Inficon software will not be able to perform a deposition. Also, regardless of whether the system control is in manual or at the end of an automated pump down sequence, deposition is not permitted to start unless the pressure in the chamber has been lower than the chamber base pressure setpoint since pumping down, and currently lower than the chamber deposition pressure setpoint. However, once a deposition has begun, the pressure may then go higher than these setpoints as long as it does not exceed the chamber safety pressure setpoint. If any fault occurs in the SCADA software during a deposition, the Inficon software will abort the process.

Inficon Index Values

The Index fields on the Process Edit page (layer tab) of the Inficon deposition control software have been assigned specific tasks. The combinations of Outputs and Index values available for this system are shown in a chart on the Source Detail and Shutter Control page of the control software. If the user creates a process with an incorrect combination an alarm is raised in the control software and the deposition process is aborted just after it is started. The first index field has been designated as the Src/Pkt index and is used to identify which source or pocket to run. This must be combined with the correct output. The second index field has been designated as Sweep and can be used in combination with output 2 (six pocket electron beam source) to select one of the four preset e-beam sweep pattern.

Note that if the user chooses “none” in the Sweep index the system will call the last sweep pattern selected before none was used. The value “none” does not overwrite the last data value for the recipe to the PLC and should not be chosen. On this system the third and fourth index fields are not used.



Src/Pkt	Sweep	Not Used	Not Used
2	4	None	None
Index	Index	Index	Index

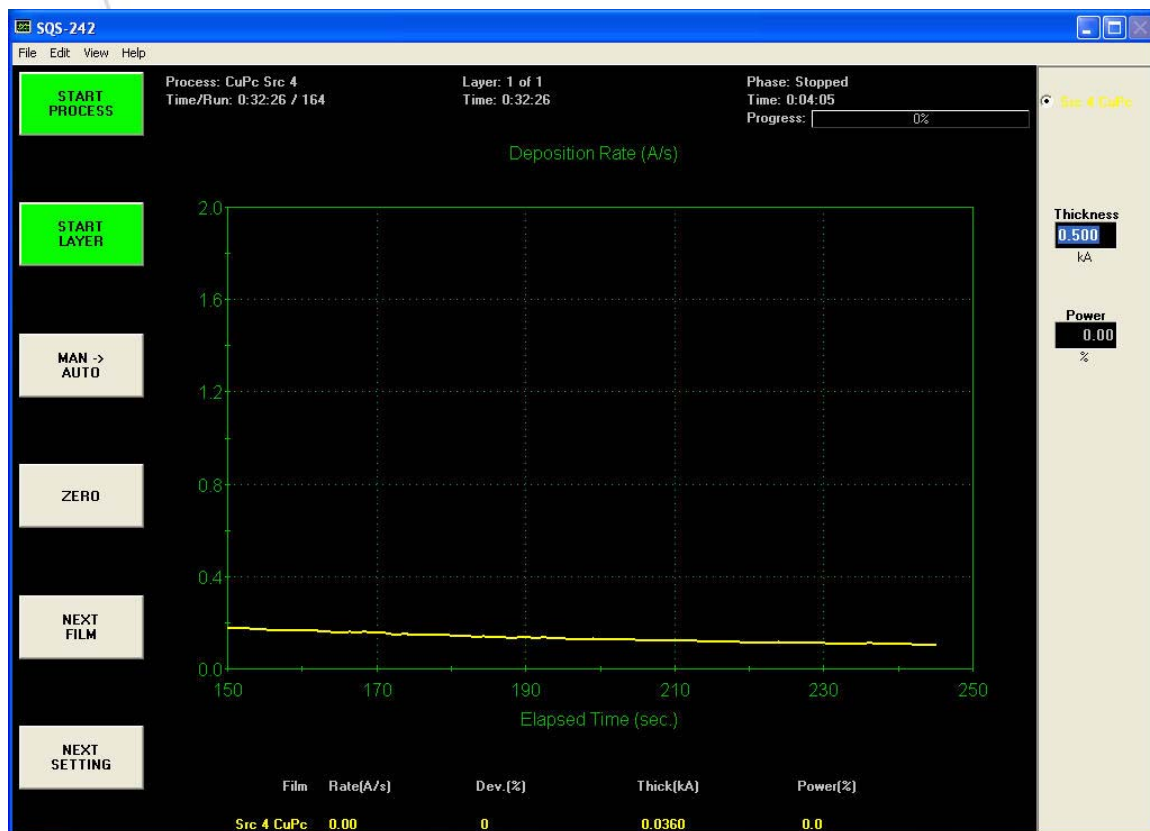
Deposition Control Methods

There are three different ways the user can choose to deposit materials using the Inficon deposition software. They can choose to run a deposition completely manually, or to control the deposition by rate or percent power.

If the user chooses to run a deposition manually, the user will control the power to the sources manually. The measured deposition rate is shown during a manual run. The Inficon software will automatically open both the source shutter required and the substrate shutter as soon as the deposition is started in manual mode (where applicable). Note that a final thickness must be specified. The Inficon software will stop the deposition and close the shutters when the specified thickness is met. Proper tooling factors must be calculated and entered in the software to ensure the thickness is accurate. Manual co-deposition is also possible (where applicable).

The user can also choose to have the Inficon software automatically control a deposition by percent power for a specific time. A final thickness can also be specified for this mode. A pre-condition is available in this mode. At the end of pre-condition the substrate shutter is opened for the deposition phase.

The user can also choose to control a deposition using the Inficon software and control the rate and thickness using a quartz crystal rate monitor. The Inficon software will control the rate to a user defined value using closed loop PID control. It does this by controlling the output power from the source power supply and monitoring the rate with a crystal rate monitor for feedback. The Inficon software will control all the shutters (where applicable) in this case and pre-conditioning is available.



Performing a Manually Controlled Deposition

It is assumed that the user has loaded a substrate holder into the chamber and set the height, ready for deposition.

The procedure to control a deposition manually is outlined below in point form.

- All interlocks required for deposition must be met. Open the System Interlocks page by clicking on the System Interlocks button. The interlocks on the left of the page must all be met (green). The loss of any of these interlocks during deposition will disable all the power supplies.
- Choose or create a process for the film or layer you wish to deposit. The conditioning will not be used for the manual deposition, nor will the rate, however the final thickness will be utilized.
- Click the auto/manual button on the Inficon screen so that only the final thickness and percent power are displayed on the right hand side of the screen, as shown above and manual is above auto in the button.
- Start the deposition using the start process button. The user can now control the power using the arrow keys, or enter values directly by highlighting the power box. The source and substrate shutters (where applicable) will be open and the deposition software will be in the deposit phase. Any rate derived will deposit on the substrate and thickness will accumulate until the final thickness is made, ending the deposition. If post condition values are present in the recipe the post condition will take place after the final thickness has been achieved.

Performing a Percent Power Deposition

All interlocks required for deposition must be met. Open the System Interlocks page by clicking on the System Interlocks button. The interlocks on the left of the page must all be met (green). The loss of any of these interlocks during deposition will disable all the power supplies.

- Choose or create a process for the film or layer you wish to deposit. The Process/Layer tab/Input box must be set to Timed Power. The conditioning can be used for a percent power deposition, and the final thickness will be utilized.
- Click the manual/auto button on the Inficon screen so that the pre-condition parameters are displayed on the right hand side of the screen.
- Start the deposition using the start process button. The user can alter the powers and times in the pre-condition if values were entered. There is no shutter delay phase for a timed deposition. The software will maintain the output percent power for the specified time or until the final thickness specified has been met. Note that proper tooling factors for the sensors must be in place if the operator wishes to control to final thickness and not for a specific time. Percent power ramps during the deposition can also be utilized.

Performing a Rate Controlled Deposition

- All interlocks required for deposition must be met. Open the System Interlocks page by clicking on the System Interlocks button. The interlocks on the left of

the page must all be met (green). The loss of any of these interlocks during deposition will disable all the power supplies.

- Choose or create a process for the film or layer you wish to deposit. The Process/Layer tab/Input box must be set to Sensor(s). The conditioning can be used for a rate controlled deposition, and the final thickness will be utilized.
- Click the manual/auto button on the Inficon screen so that the pre-condition parameters are displayed on the right hand side of the screen.
- Start the deposition using the start process button. The user can alter the powers and times in the pre-condition if values were entered. If no pre-condition values were entered the software will go to the shutter delay phase if checked in the process, and then the deposition phase. The PID control will then control the output power until the desired rate is achieved, and it will maintain the rate throughout the deposition until final thickness. Rate ramps during the deposition can also be utilized.