GENERAL PROCESS AND OPERATION SPECIFICATION

Lesker PVD 75 E-beam Evaporator

I. SCOPE

a. The purpose of this document is to describe requirements and basic operating instructions for the Lesker PVD 75, E-beam tool. This tool is intended for thin film deposition by e-beam evaporation. Use of this tool is limited to only thin films and substrates that are approved.

II. SAFETY

a. Be sure that you are trained and signed off to use this equipment.
b. Be sure to keep all doors and protective shields in place before operating this equipment.
c. Use care when operating around high voltage or high current.
d. After power has been disconnected, wait for at least 3 minutes before starting work on the power supply to allow the capacitors to discharge themselves. Also use the grounding rod to discharge the capacitors and high voltage feed thru before coming in contact with them. Touch the grounding rod to contacts around the e-gun before performing any work to change crucibles or clean the e-gun surfaces.

Fig. 1. Use of grounding rod on e-gun electrodes.

e. High pressure gas cylinders for this tool are stored in ventilated gas cabinets located in the 7H1 service corridor. Be sure to ask a staff member for assistance to change out any gases.
f. If you are unsure about any procedure or indication while operating this equipment be sure to contact a staff member or trainer for assistance.

III. APPLICABLE DOCUMENTS, MATERIALS AND REQUIREMENTS

a. For more information about the detailed operation of this tool refer to the Lesker factory manual – "PVD 75 Thin Film Deposition System Operation Manual." File name: PVD 75 Manual.pdf.
b. Hand held ebeam controller Aktuell-online.docx. Detailed instructions for operation of the e-beam control unit located inside the right side door. Available to trainers and superusers of the system.
c. Available to trainers and superusers: PED10-201 Set Up Instructions-Ferrotec E-Beam Pro Controller.docs and PED10-203 Centering the XY Sweep on a Ferrotec E-Beam Gun.docs. For manual set-up of the hand-held E-Gun controller.
d. Appendix A: Editing of Recipes in KLJ software.
e. Appendix B: Matrix of e-gun recipes, gun positions, and materials.
f. Appendix C: Logbook Information for the PVD 75 E-beam tool.
g. Appendix D: Screen Shots of Running a Recipe
h. For detailed information in the operation of the Inficon thickness monitor see factory manual. File name: Inficon Film Thickness Monitor_074_156L Front Load Single Dual Sensors OM.pdf.
i. For a table of Z-Ratio and density for various materials refer to the file "Z Ratio and Density Table."
j. For a general reference of vapor pressures for a variety of e-beam source materials see the RCA reference: vaporpressure4 Ebeam materials RCA.pdf.
k. This tool is intended to be used with a restricted selection of substrate and evaporation materials.
l. Approved evaporation materials. Materials provided by AggieFab as part of normal lab fees are: Al, Cr, Cu, Ti, Ni. For a complete list of other approved materials refer to Appendix B in this document.
m. Approved substrate materials: Glass, Si, PVDF (with no substrate heating)
n. Other substrate and evaporation materials must be pre-approved by the Materials Review Board before running in this tool.

IV. OPERATION

NORMAL OPERATIONS FOR REGULAR AGGIEFAB USERS:

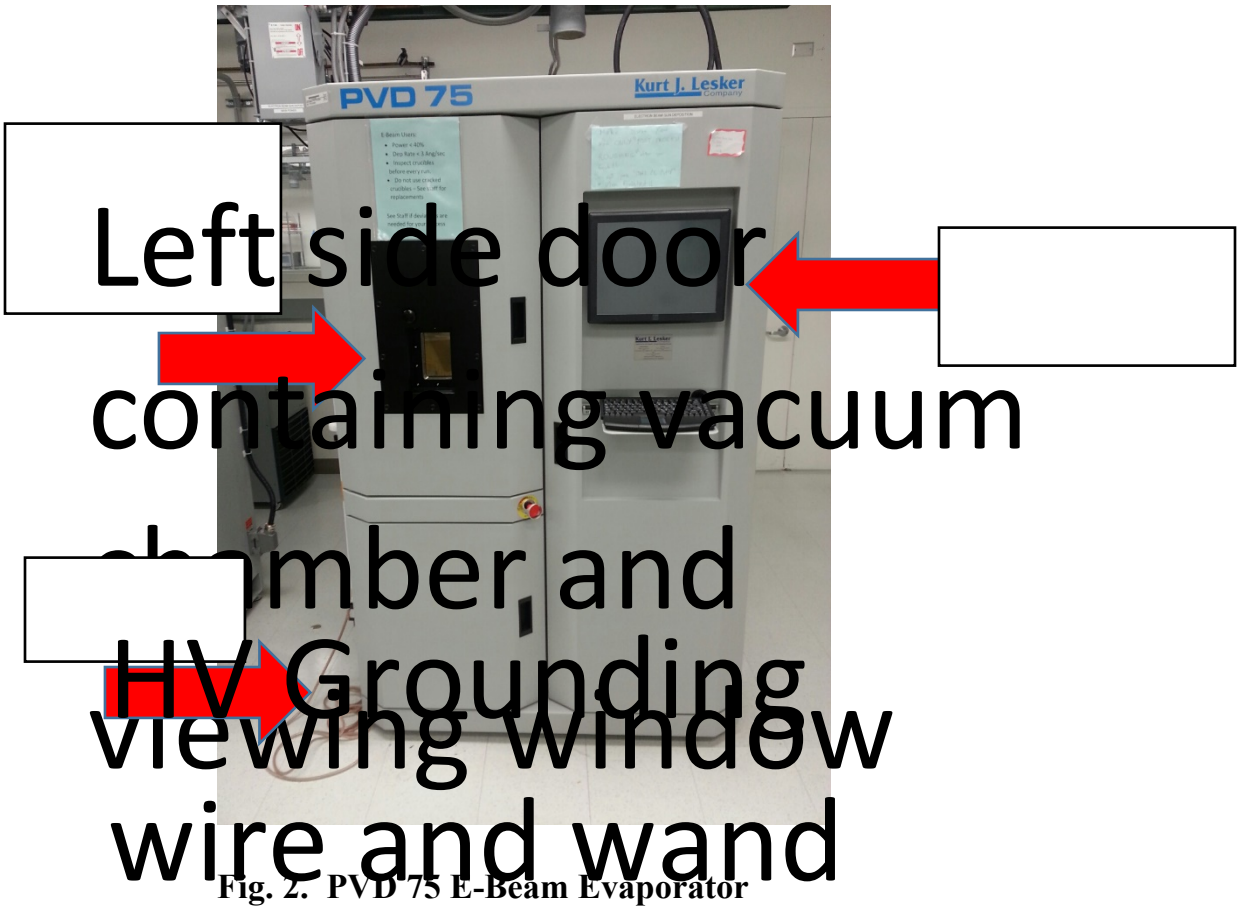


Fig. 2. PVD 75 E-Beam Evaporator

1) Logbook Entries: Enter the time, date and name
    a. Before run is complete, be sure enter all recipe and process information as shown in the logbook page
    b. See Appendix C for a template of the logbook information.
    c. During the run, fill out all the information pertaining to the run parameters.
2) Open the vacuum chamber to prepare the tool for loading of your sample. Run "Start PC Vent" on the main Vacuum screen, or select it from the options provided on the "Run Recipe" soft button. Both of these soft buttons are visible on the right side of the main vacuum screen. See Fig. 2.

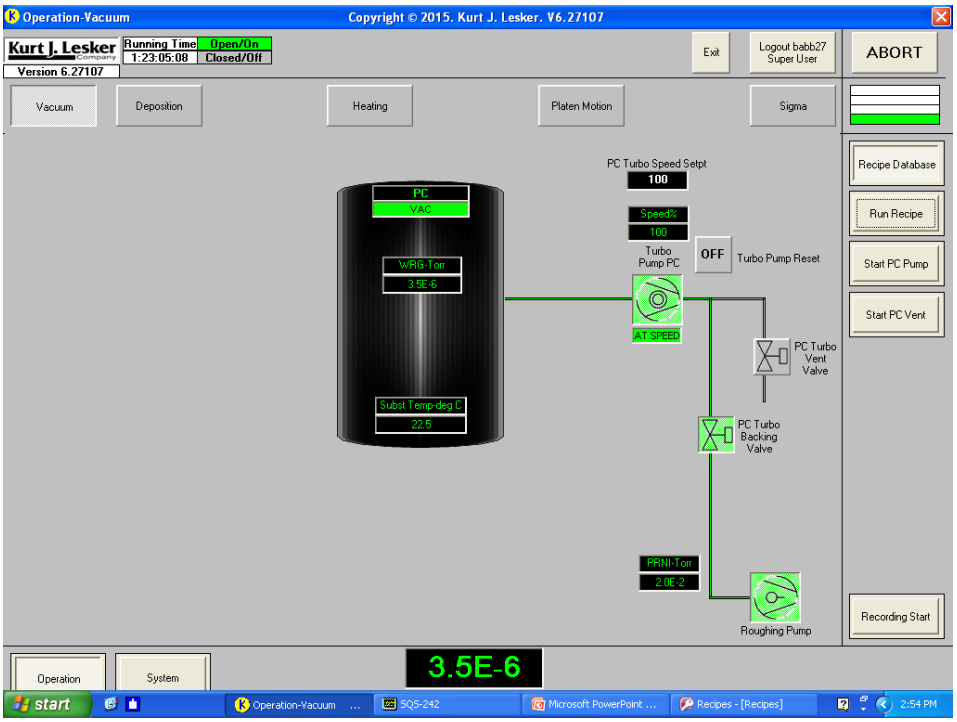


Fig. 3. Main Vacuum screen for the PVD 75 E-Beam tool. Other soft buttons are available across the top to view and set up Deposition, Heating (substrate), Platen Motion, and Sigma software control. Note that this tool does not have a separate vacuum line and valve to allow roughing of the chamber. It is necessary to shut down the turbo pump prior to venting and perform rough pumping from atmosphere through the turbo pump, prior to starting the turbo pump.

3) The High Voltage (HV) for the e-beam should be off while venting.
4) Be sure to wear a face mask and clean nitrile gloves before working inside the vacuum chamber. This protects surfaces inside the vacuum chamber from human contamination; primarily sodium from finger oils, moisture from breathing, and particles from facial hair and skin.
5) When the chamber reaches atmospheric pressure open the chamber, but DO NOT TOUCH anything inside until precautions have been taken regarding the high voltage that is used to power the e-beam. See steps 6 and 7 below!
6) From the PC control screen open the shutters to access the crucibles in the e-gun (bottom of chamber) and the substrate/sample holder (top of the chamber).
    a. Run recipe LOAD/UNLOAD. This recipe automatically opens the e-beam and substrate shutters. Also, the substrate holder will rotate to the home position to enable removal from the rotation rod.
7) USE THE GROUND ROD to ensure that no unsafe charge is present around the e-gun. See also Fig. 1 in SAFETY section, c and d. Hold the ground rod with one hand from the end of the dielectric rod to ensure adequate space from conducting surfaces.
8) Determine the proper pocket position and e-gun profile for the desired material. Note that most metals have a specific pocket and e-gun profile that ensures the best evaporation performance. See Appendix B for a complete list of these parameters.

9) Inspection of e-gun pockets and preparation of crucibles – change or loading.
    a. Open the right-hand door that contains the PC keyboard and display monitor.
    b. Locate the remote e-gun controls inside the door.
    c. Figure 4 shows the remote e-gun control in the automatic mode used for normal operations.
    d. To change or inspect crucibles the e-gun control must be moved to manual operation. The crucible indexer will not work when the chamber is open while it is in the default manual mode. Press MENU/QUIT.
    e. Use the left joy stick to select "Set Pocket". See also Figure 5a. Use right joy stick to move up or down to the desired pocket/material choice. When the desired pocket/material is highlighted press and hold the right joy stick to the right until the "SEARCH" indicator goes away and the desired pocket name is displayed. This can also be done by observing the motion of the e-gun pockets. The joy stick can be released when the gun pockets stop moving. Fig 5a and 5b shows some of the parameters that can be selected.
    f. Inspection and cleaning of crucible and gun pocket. Very important! Damaged crucibles can allow the electron beam to penetrate to the copper e-gun pocket. This can destroy the gun and risk a water leak that can ruin the entire vacuum system!
        i. Be sure that you have clean nitrile gloves and a face mask before working inside the vacuum chamber and handling any components.
        ii. Carefully remove the crucible from the gun pocket. Avoid touching any e-gun surfaces while loading the new crucible
        iii. Tweezers or Kapton tape may be used to lift the crucible out.
        iv. Inspect the crucible for any signs of cracks or holes on both the top side and the back side. DO NOT use a crucible if there is any sign of damage.
        v. Inspect the copper e-gun pocket for any trace of source material, or oxidation. The crucible needs to be in good contact with the entire pocket and free of oxidation in order to properly conduct away heat.
            1. Prior to every run: Use swabs with IPA or methanol to clean light oxidation. Continue process until only a slight amount of dark discoloration is seen on the swab. The white abrasive pads may also be used to remove more difficult residue from the e-gun pocket.
            2. If it is not possible to properly clean up the pocket, CONTACT A STAFF MEMBER for help.
        vi. Fill new crucibles, or add to existing melts from approved source material containers.
            1. If starting a fresh crucible, fill the source pellets to the top to allow for settling during the melt process.
            2. If using an existing melt/crucible be sure that the crucible is at least 50% full. Additional source pellets should be added if needed.
            3. Do not overfill the crucible, and be sure that pellets do impede free rotation of the pockets under the top of the e-gun.
        vii. When all crucibles have been loaded, rotate the e-gun pockets back to the original crucible using manual mode and then change to auto mode. Now the crucible indexer will automatically adjust the position. See Fig. 5a.

viii. Change any labels in the e-gun software to properly identify the materials in each pocket/crucible.

Fig. 4. Hand held E-beam controller is located behind the right side door.

Fig. 5a. Crucible pocket selection for hand held e-gun controller.

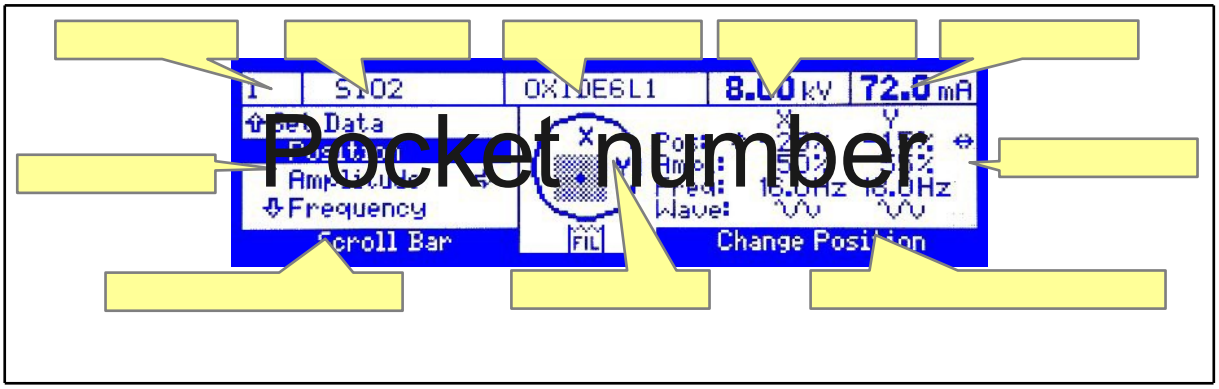


Fig. 5b. Menu selections for hand held e-gun controller.

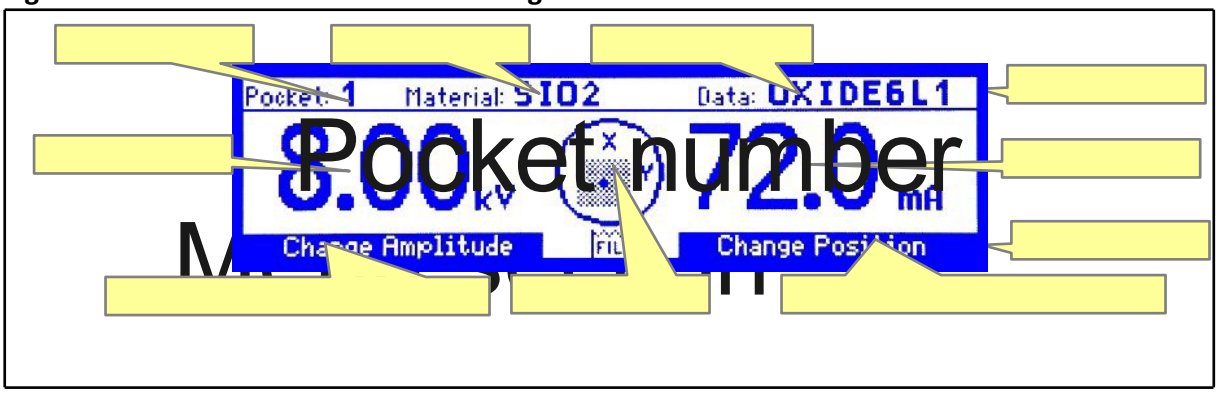


Fig. 5c. Additional parameters on the hand held e-gun controller.

9) Loading wafers or samples
   a. Remove substrate holder from vacuum chamber by carefully lifting the round substrate holder up until it is clear of the alignment pins on the rotation rod. Then pull it straight out until it is clear of the shutters and the rotation rod.
   b. Set/ fix your wafers unto substrate holder with the screw-down clips or Kapton tape
   c. Load substrate holder and samples into vacuum chamber.
   d. Close or complete the LOAD/UNLOAD recipe. Shutters will return to normal position.

High voltage

Function of left Joysti

Fig. 10: Menu screen exampl

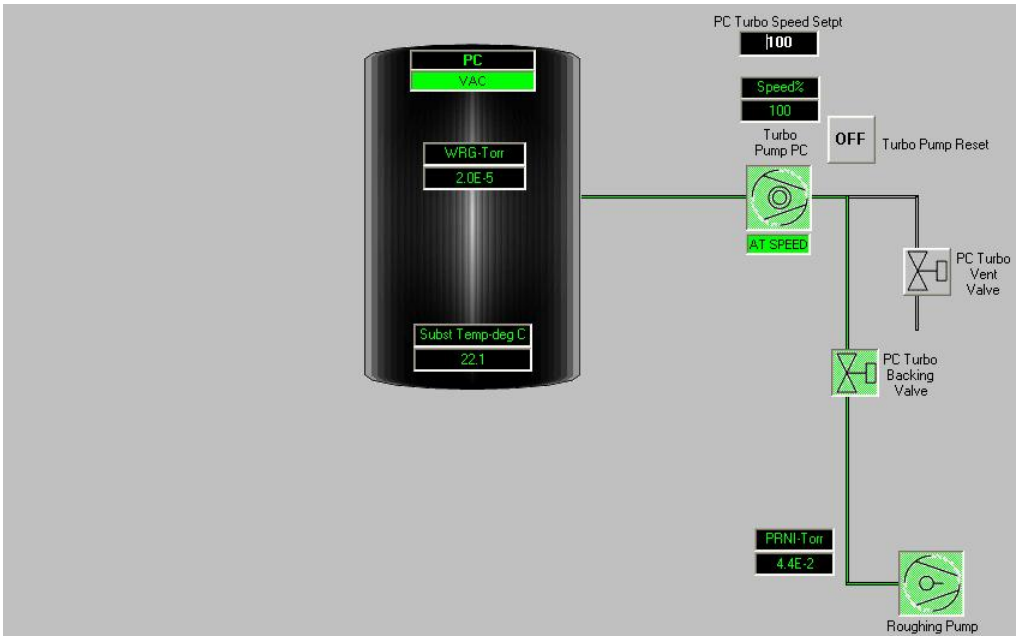
10) Check the film thickness sensor 1 (View – Sensor Settings): If life is less than 40% then change the crystal.
11) Close the chamber
12) Begin evacuation of the process chamber by selecting "Start PC Pump" on the main vacuum menu screen.
    a. Roughing pump will automatically start the evacuation process.
    b. The turbo pump, turbo backing valve will automatically sequence correctly as the pressure comes down.
    c. Process recipes can begin once pressure reaches 5x10E-6 Torr
13) Selecting and Running a Recipe.
    a. Running recipes on the PVD 75 E-beam tool requires 2 levels of control software. The Sigma (SQS-242) E-gun software runs inside the basic KJL recipe software. The "K Operation" or basic KJL software is used to select the desired recipe and initiate the run. The Sigma software controls all the parameters associated with the e-gun operation.
    b. Open the Sigma, or SQS-242 software.
    c. Follow the steps in Appendix D for details regarding the set-up and editing of recipes. Includes checking:
        i. Select "Edit" → See "Process Edit" See the Pop-up Menu
            1. From the drop down window select the desired metal process
            2. Edit or modify the following:
                a. Set point for deposition rate (A/sec). Set initial rate for $\leq$ 1 A/sec to avoid spattering. Can adjust higher after beam is running, if desired.
                b. Set "Final Thick" (kA) of the desired film
            3. Select "Deposit" tab to view or change shutter delay settings
            4. Select "Condition" tab to view or modify Pre and Post Ramping conditions. See also Appendix B for suggested parameter settings.
                a. Set Pre Condition Ramp 1 & 2 Power, Ramp 1 & 2 time, Soak 1 & 2 time.
                b. Aging of the "melt" in the crucible. Appendix B has a suggested range of parameters for materials where the crucible melt tends to "age". Use the lower power settings for newer melts.
                c. Set or check the post condition parameters.
            5. Go to "Source/Sensor" tab to note Sensor Tooling in the logbook
                a. Tfilm = Tmonitor X Tool Factor
                b. Make sure this is correct for the material you are using
            6. Click "Yes" on the "Change Process" pop up menu to change or save the new metal deposition process
14) From the main KJL screen, set substrate Temp. See Figure 3. Comply with substrate heat restrictions for certain materials such as PVDF. See Section III for approved substrate materials.
15) After setting all the changes (edit process) close the SQP software
16) Make Log Book entries: Identify Material, Pocket Position, Gun Profile, and other information as requested on the form. See also Appendix C.

17) Run Recipe
18) After recipe is complete, select “Start PC Vent”. Recipe will allow turbo pump to spin down to 50% gradually. The venting operation will take about 30 minutes, which also allows the egun to cool to room temperature.
19) Select the “LOAD/UNLOAD” recipe to open the shutters and move the substrate holder to the home position.
20) Remove sample and return substrate holder into the chamber.
21) Crucible may be removed if desired.
22) Complete the “LOAD/UNLOAD” recipe which closes the shutters to normal position.
23) Post processing:
    a. Rough down chamber - Select “Roughing”. Pump chamber with roughing pump only, and not the turbo pump.
    b. Leave system under rough down pressure for the next user.

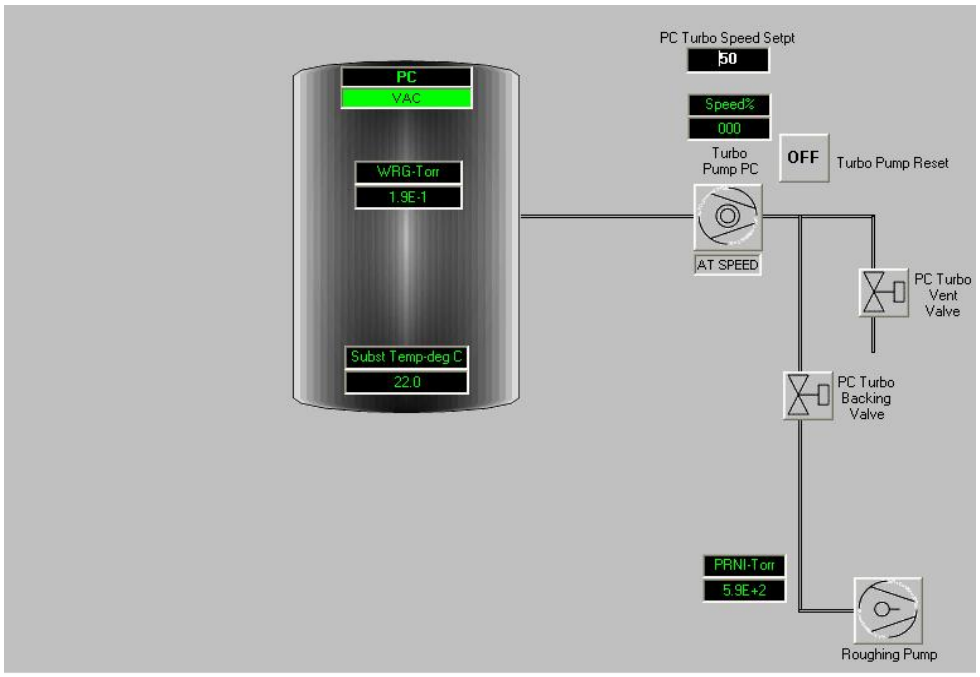
Normal OPERATION Screen Shots:

VACUUM SCREEN – See following three screen shots for actual run conditions for Pumping, Pumps Off, and Venting.

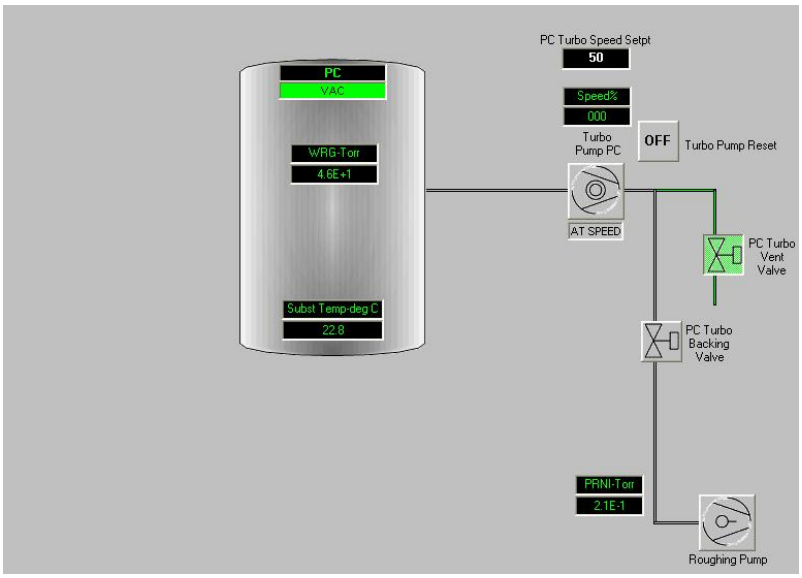
E-Beam systems are hard-wire interlocked to the VAC switch. When the system is roughed below ATM, the VAC (Vacuum Switch) turns green and indicates PC is under vacuum. The KJLC software interlock for minimum operation pressure is 5x10-4Torr; although the recommended optimum pressure is 4 x 10-5 Torr or better.



Pumping ^



Pumps Off



Venting

Fig. 6 a-c. Vacuum screen shots.

DEPOSITION SCREEN

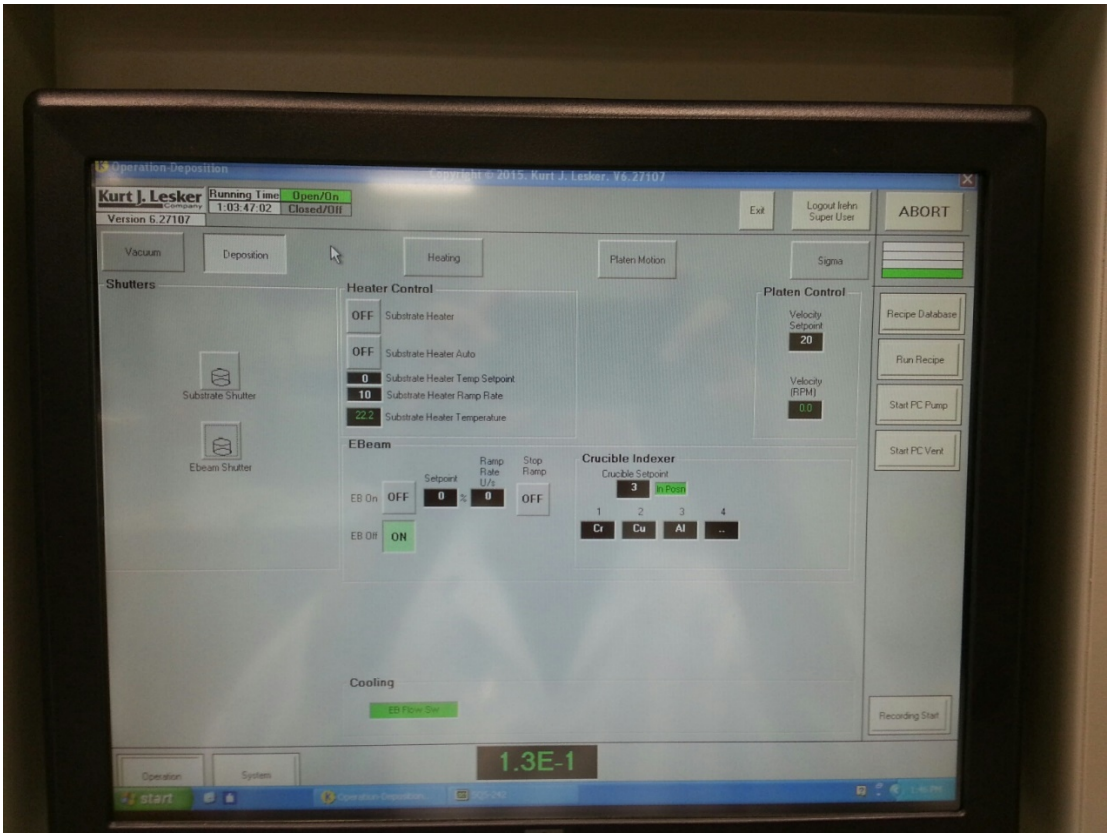


Fig. 7. Deposition Screen shots.

V. SIGNATURES AND REVISION HISTORY

a. Author of this document: Larry Rehn
b. Author Title or Role: Technical Manager
c. Date:
d. Revision: Original Issue

Approvals:

Technical Manager Signature:_____

Date: _____

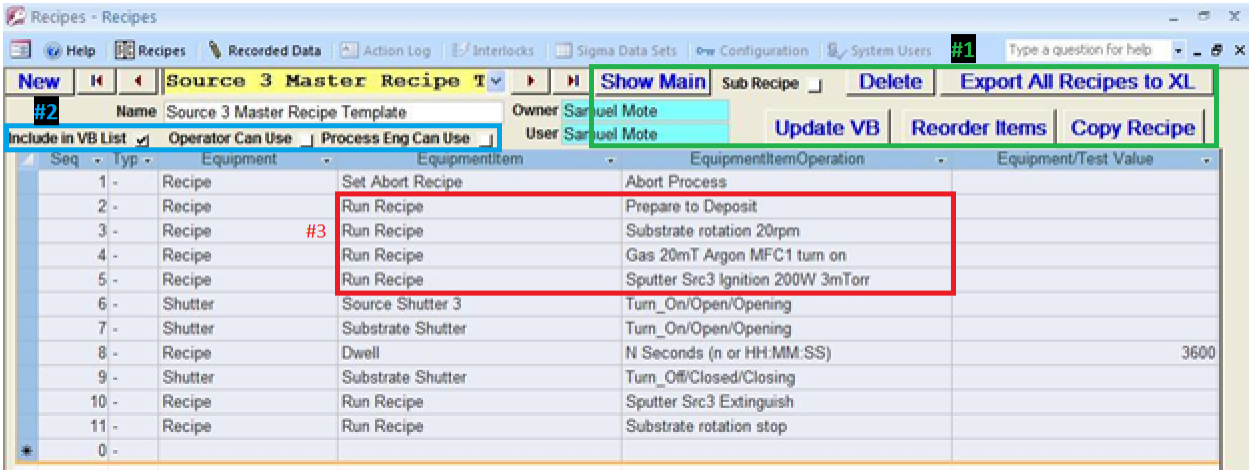
Revision History:

Revision	**Author**	**Date**
Original Issue	L. Rehn	
Rev A		9/11/2015
Rev B		
Rev C		

Appendix A – Editing of Recipes in KLJ Software:

Editing Recipes

Note: You can only edit recipes if you are the owner or if the owner has opened access to you for editing. The owner of a file cannot be changed and only the owner or a system administrator can delete the file.



#1:

Show Main/(Show All): Toggles the yellow recipe list between showing only Main Recipes or both Main and Sub Recipes. (The button displays the opposite of what is being used. For example, when the button reads “Show Main”, the recipe list will be showing all.)
Sub Recipe Check Box: Defines Recipe as a Sub Recipe; Default as Main Recipe
Delete: Remove Recipe file
Export All Recipes to XL: Used only by system administrators
Update VB: Save all recipes that have been edited
Reorder Items: Move lines of the recipe
Copy Recipe: Create new recipe file with all of the same specifications currently selected. You will become the “Owner” of the new file.

#2:

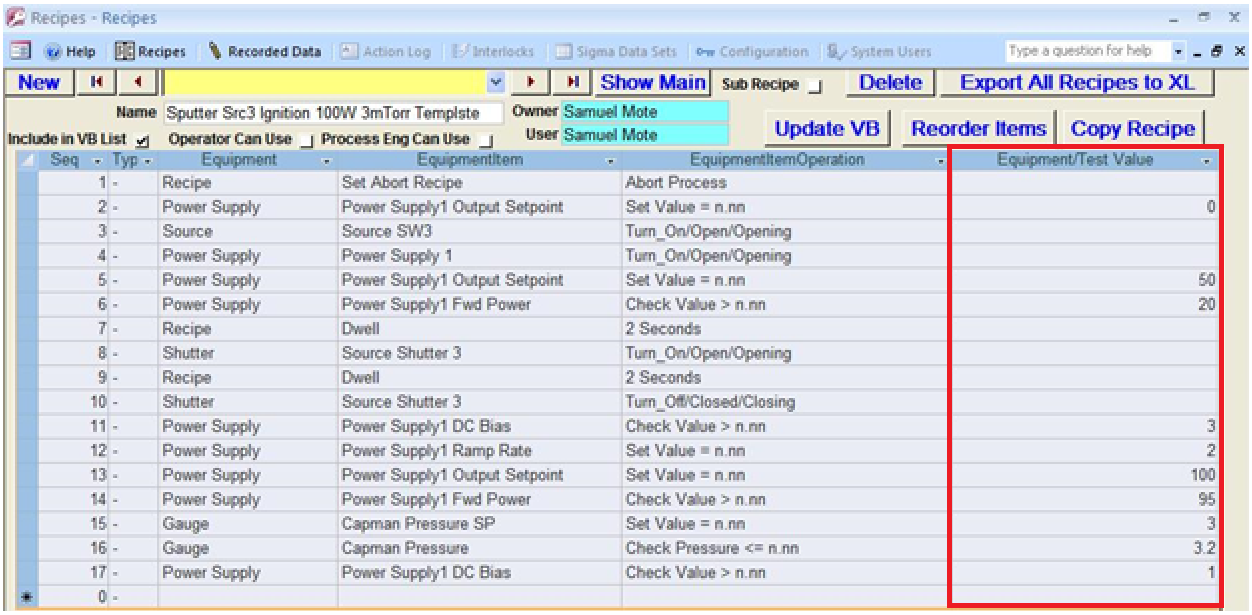
Include in VB List Check Box: (Default checked.) If checked, and if the recipe is a main recipe, it will be made visible in the yellow recipe list when Show Main is selected. If not checked, it will only show when Show All is selected.
Operator /Process Eng Can Use Check Boxes: (Default unchecked.) These boxes specify what groups are given access to editing the recipe file. If unchecked, only the owner and system administrators can edit it.

#3:

If the “Equipment/Item” column reads “Run Recipe”, then the next column will specify what Sub Recipe is being called. Sub Recipes contain most editable parameters of a process. By clicking on the Sub Recipe name, a drop down box will appear that will allow you to select which specific Sub Recipe to run. Other “Equipment/Item” commands specify an action to be taken within the Main Recipe.

Editing Sub Recipes

Sub Recipes are where most parameters are defined.



Seq	Typ	Equipment	EquipmentItem	EquipmentItemOperation	Equipment/Test Value
1	-	Recipe	Set Abort Recipe	Abort Process	
2	-	Power Supply	Power Supply1 Output Setpoint	Set Value = n.nn	0
3	-	Source	Source SW3	Turn_On/Open/Opening	
4	-	Power Supply	Power Supply 1	Turn_On/Open/Opening	
5	-	Power Supply	Power Supply1 Output Setpoint	Set Value = n.nn	50
6	-	Power Supply	Power Supply1 Fwd Power	Check Value > n.nn	20
7	-	Recipe	Dwell	2 Seconds	
8	-	Shutter	Source Shutter 3	Turn_On/Open/Opening	
9	-	Recipe	Dwell	2 Seconds	
10	-	Shutter	Source Shutter 3	Turn_Off/Closed/Closing	
11	-	Power Supply	Power Supply1 DC Bias	Check Value > n.nn	3
12	-	Power Supply	Power Supply1 Ramp Rate	Set Value = n.nn	2
13	-	Power Supply	Power Supply1 Output Setpoint	Set Value = n.nn	100
14	-	Power Supply	Power Supply1 Fwd Power	Check Value > n.nn	95
15	-	Gauge	Capman Pressure SP	Set Value = n.nn	3
16	-	Gauge	Capman Pressure	Check Pressure <= n.nn	3.2
17	-	Power Supply	Power Supply1 DC Bias	Check Value > n.nn	1
0	-				

Equipment/Test Value: This is where the parameters of a Sub Recipe within a process are defined and edited. The same owner permissions are required as in a Main Recipe for editing.
If there are a set value and a check value for the same parameter, make sure to change both values together to keep the logic true. For example, if the power is set to 200 W and the check is set to greater than 190 W originally, and you want to drop to only 100 W set point, make sure that the check point is reduced similarly to greater than 95 or something close.

Appendix B – Matrix of E-gun Recipes, Gun Position, and Materials:

					Precondition	
Material	**Provided by AggieFab – Y/N**	**Approved for use**	**Gun Pocket Position**	**Gun Profile**	**Ramp1**	**Ramp2**
Al (existing crucible/melt)	Y	Y	3	ALP310KV	10-15% [1]	15-20% [1]
Al (new crucible)	Y	Y	3	ALP310KV	5% [2]	10% [2]
Cr	Y	Y	1	P1_M10KV		
Cu	Y	Y	4	P4_M10KV		
Ti	Y	Y	2	META10KV		
Ni	Y	Y	1	P1_M10KV		
Alumel	N	Y	1	P1_M10KV		
Gold	N	Y	4	P4_M10KV		
Chromel	N	Y	1	P1_M10KV		
Tantalum	N	Y	4	P4_M10KV		
Molybdenum	N	Y				
Tungsten	N	Y	2	META10KV		
Platinum	N	Y	3	META10KV		
Silver, Ag	N	Y	3	META10KV		
Silicon, Si	N	Y	3	META10KV		
Iron, Fe	N	Y	1	P1_M10KV		
TaN	N	Y	4	P4_M10KV		

Note 1: "Aging" of the aluminum melt requires that the Ramp 1 and Ramp 2 precondition power be set to higher power as the crucible/melt has been used multiple times. This tracks the deposition power which also will tend to increase from around 20% to 40% +. Use the lower range of ramp up power when the crucible/melt has only been run 1-2 times. Consult the logbook to note the deposition power used on prior runs for aluminum to ensure that the Ramp 1 and Ramp 2 precondition power is set below expected deposition power.

Note 2: When using a new crucible and fresh aluminum pellets the Precondition Ramp 1 and Ramp 2 power must be reduced to allow proper melting of the pellets. The metal will first melt into a ball, and then begin to spread out inside the crucible. Until the metal spreads into the crucible, there is not sufficient heat transfer to allow higher power levels of operation. Note that normal precondition ramp power settings may be used if additional pellets have been loaded into an existing crucible/melt.

Appendix C – Logbook Information

Date: _____
Name: _____

	TIME	AM/PM
Log In:		
Log Out:		

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1 M: _____ GP: _____ 2 M: _____ GP: _____

SUBSTRATE MATERIAL	SUBSTRATE ROTATION (rpm)	SUBSTRATE HEATING (°C)

3 Material: _____ Gun Profile: _____ 4 Material: _____ Gun Profile: _____

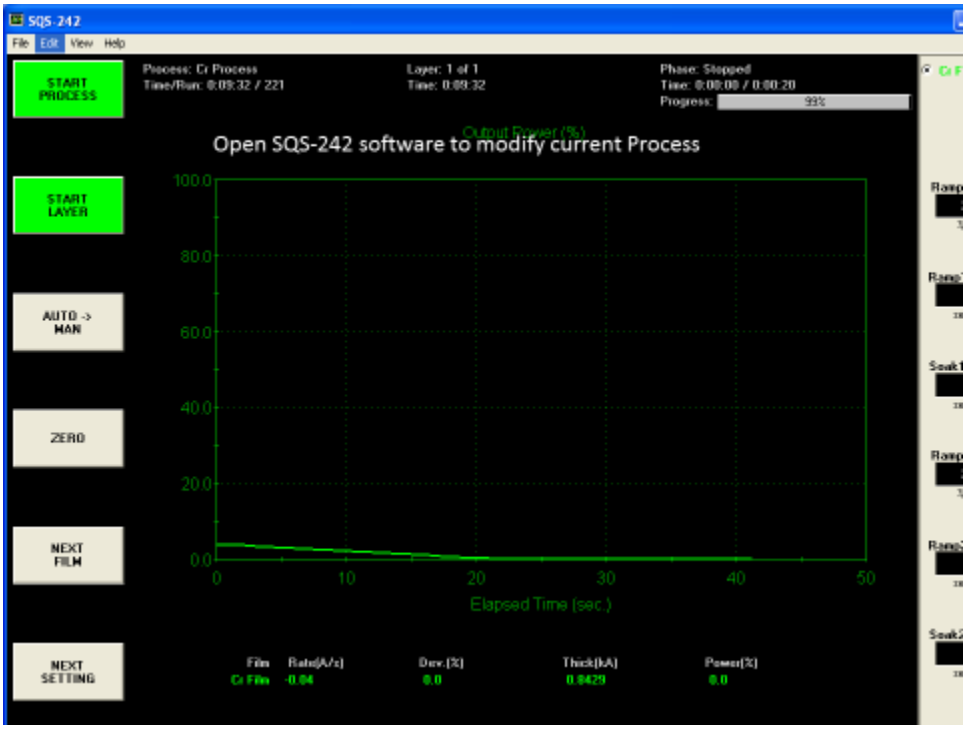
BASE PRESSURE (Torr)	PROCESS PRESSURE (Torr)

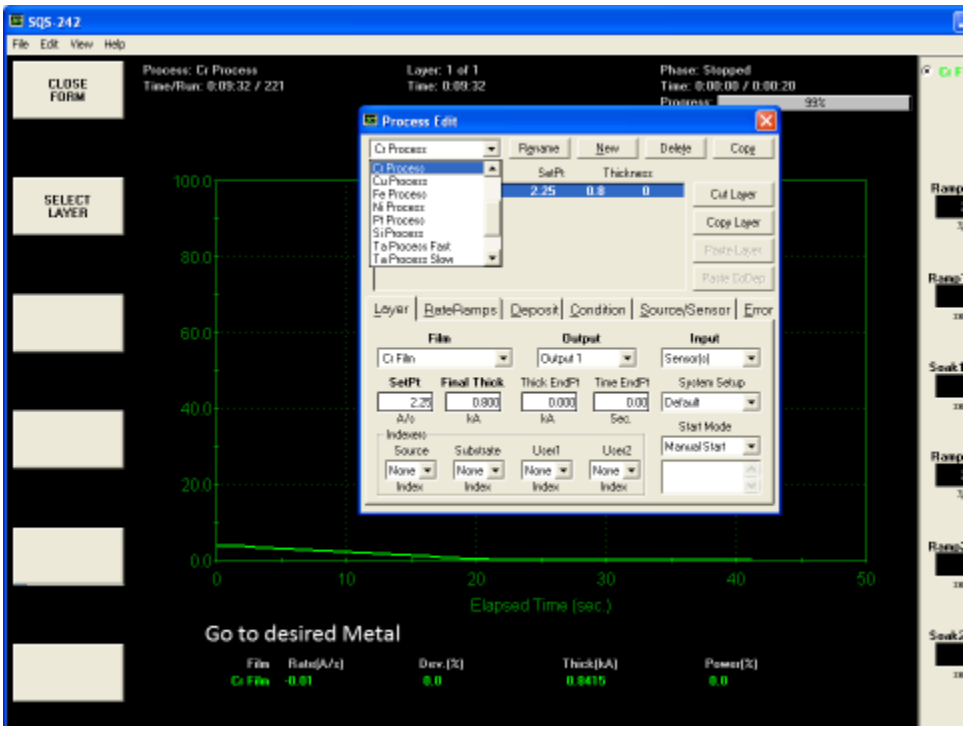
RECIPE NAME	MATERIAL	SIGMA PROCESS	SIGMA FILM	TOOLING	TARGET DEP RATE (A/s)	TARGET THICKNESS (A)	MELT POWER (%)	DEP POWER (%)

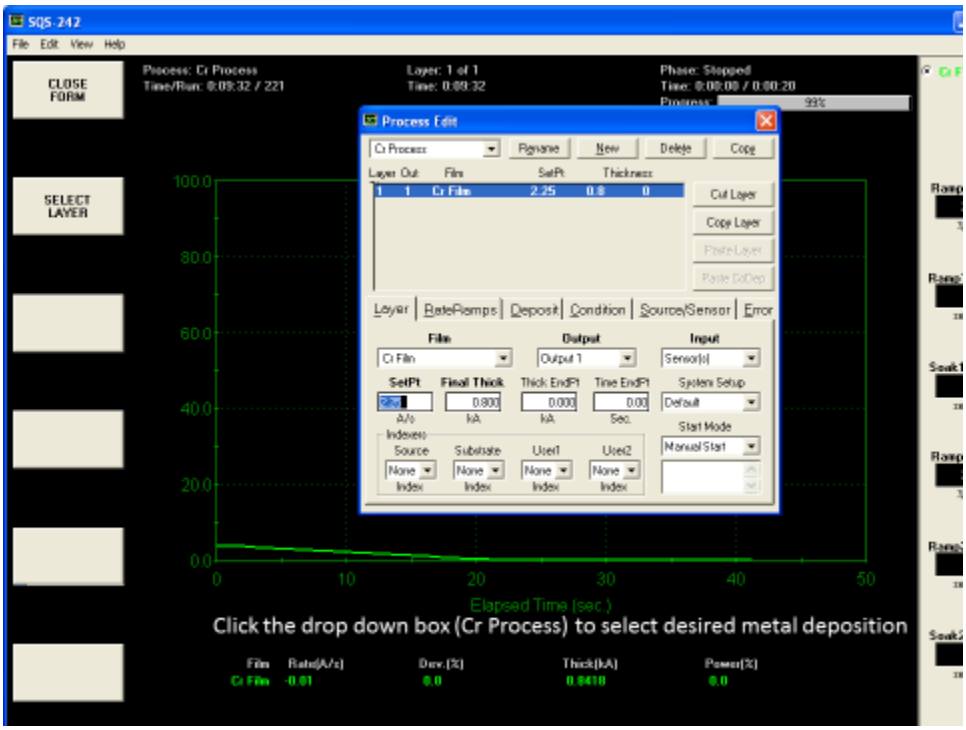
Errors:

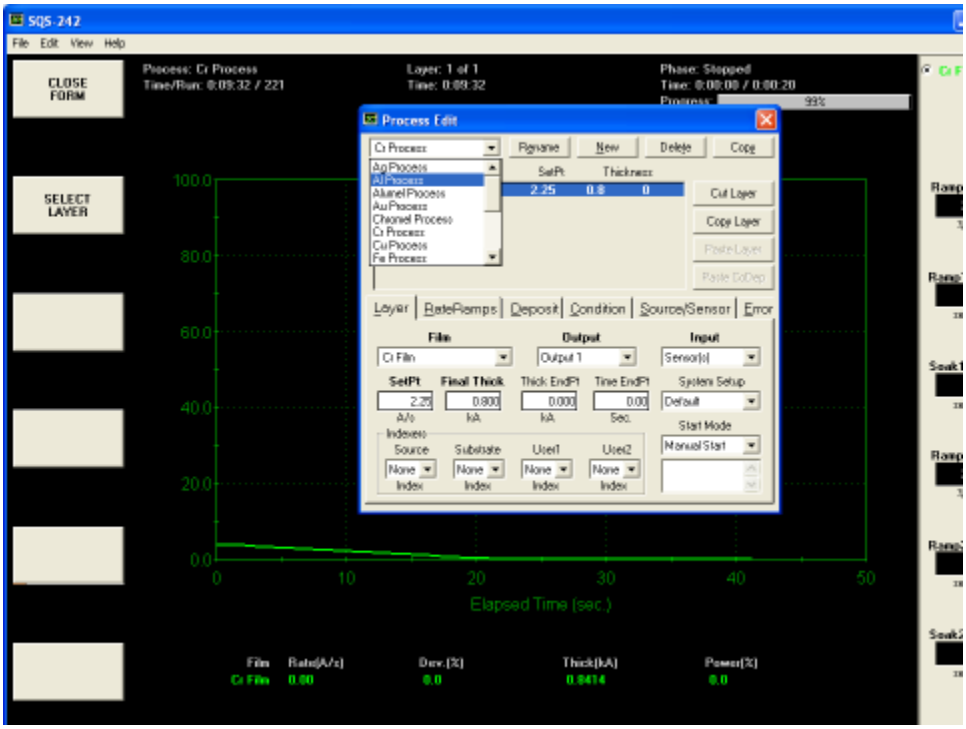
Comments:

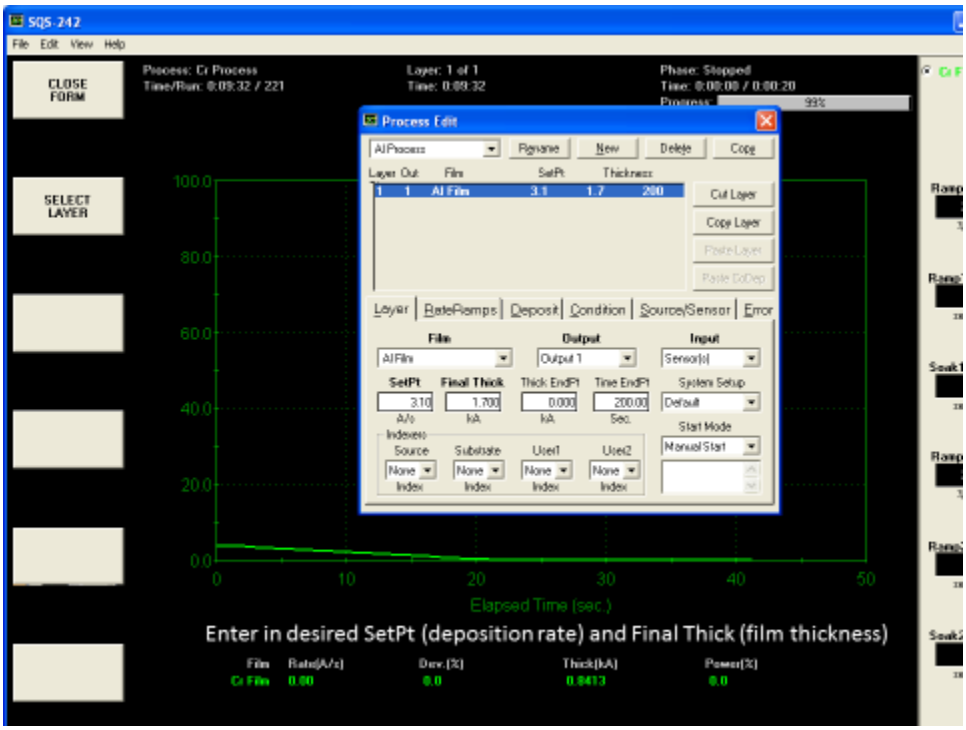
Appendix D – Screen Shots of Running a Recipe

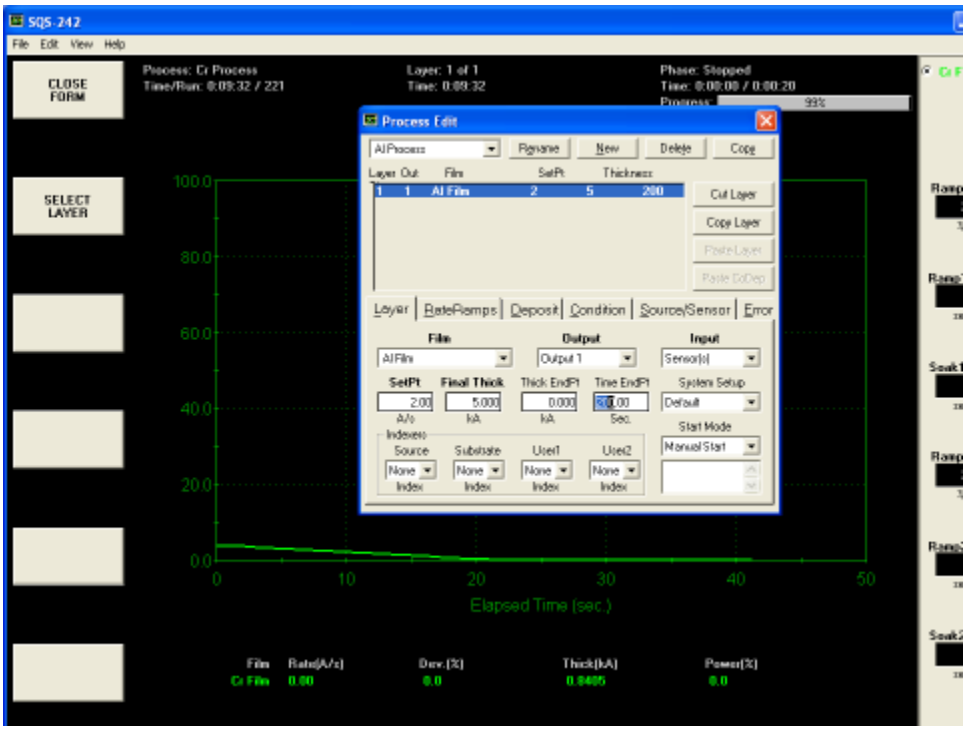




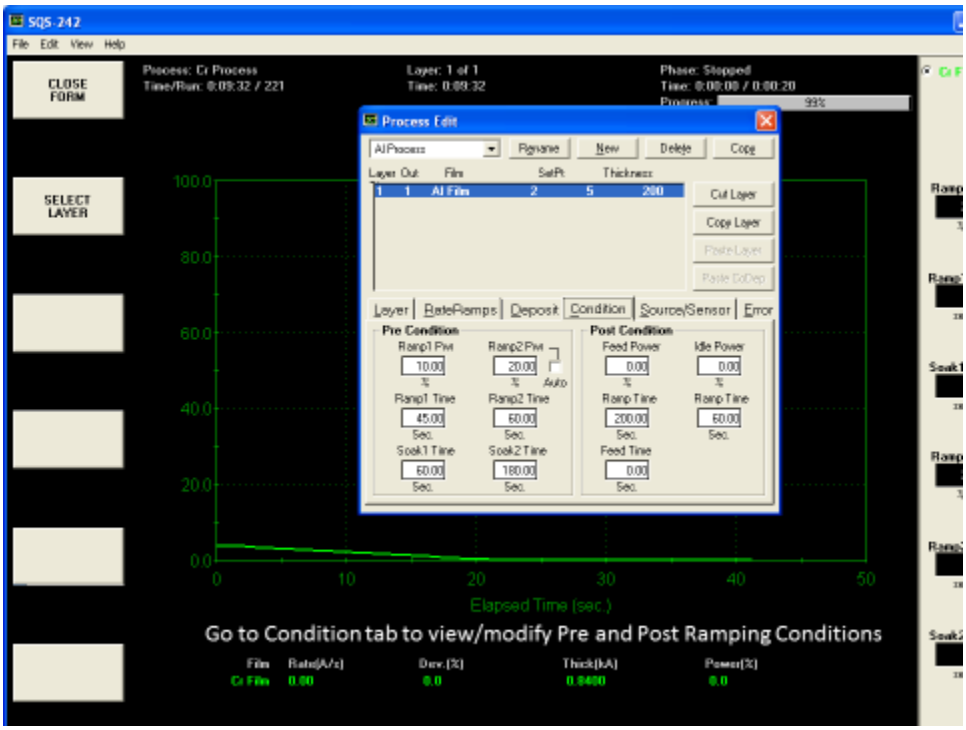

SQS-242
File Edit View Help
CLOSE FORM
SELECT LAYER
Process: Cr Process
Time/Run: 0:09:32 / 221
Layer: 1 of 1
Time: 0:09:32
Phase: Stopped
Time: 0:00:00 / 0:00:20
Process Edit
Cr Process
Rename
New
Delete
Copy
Layer Out Film SetPt Thickness
1 1 Cr Film 2.25 0.8 0
Cut Layer
Copy Layer
Paste Layer
Paste toDep
Layer | RatePlamps | Deposit | Condition | Source/Sensor | Error
Film
Output
Input
Cr Film
Output 1
Sensor(s)
SetPt
Final Thick
Thick EndPt
Time EndPt
System Setup
A/s
kA
kA
Sec.
Default
Start Mode
Manual Start
Indexes
Source
Substrate
User1
User2
None
Index
1000
800
600
400
200
0.0
0
10
20
30
40
50
Elapsed Time (sec.)
Click the drop down box (Cr Process) to select desired metal deposition
Film
Rate(A/s)
Dev.(%)
Thick(kA)
Power(%)
Cr Film
-0.01
0.0
0.0418
0.0

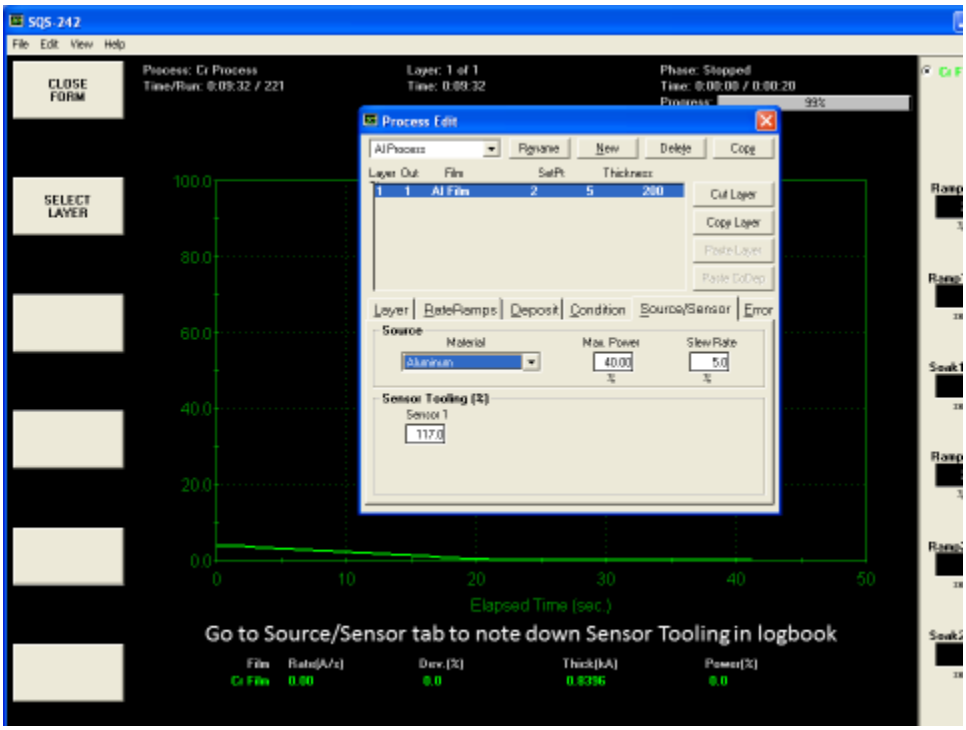

SQS-242
File Edit View Help
CLOSE FORM
SELECT LAYER
Process: Cr Process
Time/Run: 0:09:32 / 221
Layer: 1 of 1
Time: 0:09:32
Phase: Stopped
Time: 0:00:00 / 0:00:20
Process Edit
Cr Process
Rename
New
Delete
Copy
Ag Process
Al Process
Alumel Process
Au Process
Chromel Process
Cr Process
Cu Process
Fe Process
SetPt
Thickness
2.25 0.8 0
Cut Layer
Copy Layer
Paste Layer
Paste toDep
Layer | RatePlamps | Deposit | Condition | Source/Sensor | Error
Film
Output
Input
Cr Film
Output 1
Sensor(s)
SetPt
Final Thick
Thick EndPt
Time EndPt
System Setup
2.25
0.800
0.000
0.00
Default
A/s
kA
kA
Sec.
Start Mode
Manual Start
Indexes
Source
Substrate
User1
User2
None
Index
1000
800
600
400
200
0.0
0
10
20
30
40
50
Elapsed Time (sec.)
Film
Rate(A/s)
Dev.(%)
Thick(kA)
Power(%)
Cr Film
0.00
0.0
0.0414
0.0

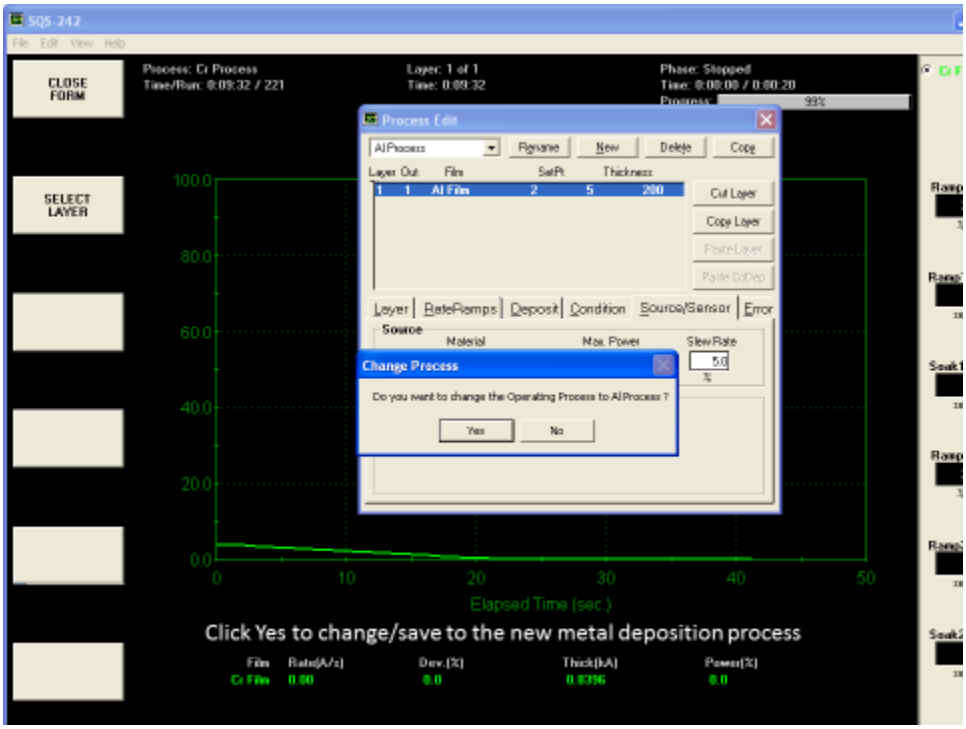

SQS-242
File Edit View Help
CLOSE FORM
SELECT LAYER
Process: Cr Process
Time/Run: 0:09:32 / 221
Layer: 1 of 1
Time: 0:09:32
Phase: Stopped
Time: 0:00:00 / 0:00:20
99%
Process Edit
AlProcess
Rename
New
Delete
Copy
Layer Out Film SetPt Thickness
1 1 Al Film 3.1 1.7 200
Cut Layer
Copy Layer
Paste Layer
Paste toDep
Layer RatePlramps Deposit Condition Source/Sensor Error
Film
Output
Input
AlFilm
Output 1
Sensor(s)
SetPt
Final Thick
Thick EndPt
Time EndPt
System Setup
3.10
1.700
0.000
200.00
Default
A/s
kA
kA
Sec.
Start Mode
Manual Start
Indexes
Source
Substrate
User1
User2
None
None
None
None
Index
Index
Index
Index
1000
800
600
400
200
0.0
0
10
20
30
40
50
Elapsed Time (sec.)
Enter in desired SetPt (deposition rate) and Final Thick (film thickness)
Film Rate(A/s) Dev.(%) Thick(kA) Power(%)
Cr Film 0.00 0.0 0.0413 0.0

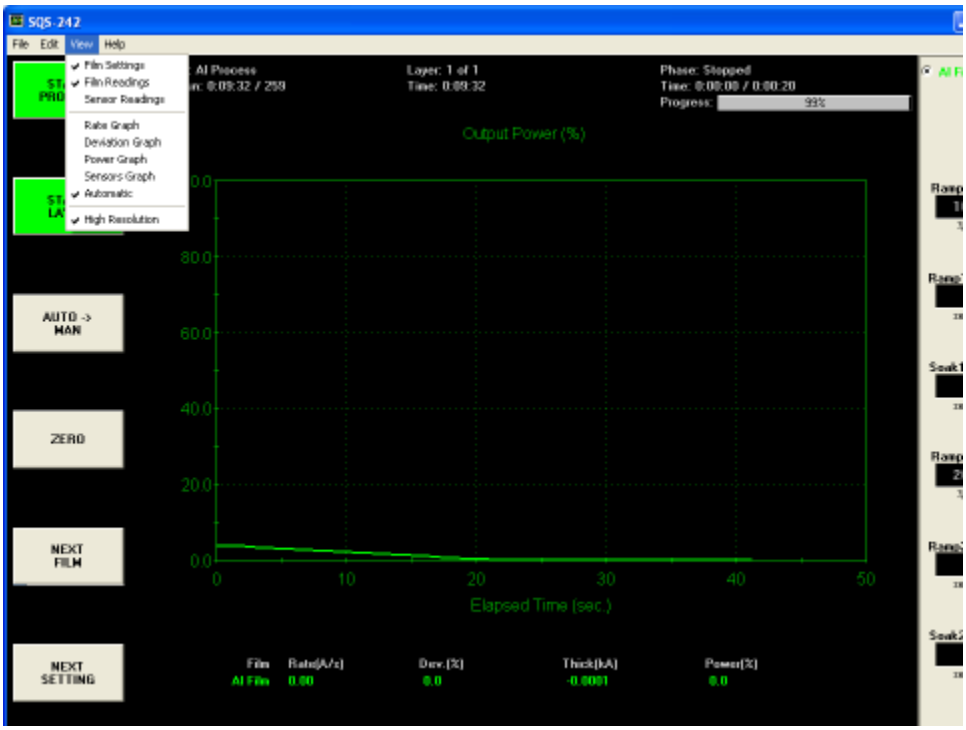

SQS-242
File Edit View Help
CLOSE FORM
SELECT LAYER
Process: Cr Process
Time/Run: 0:09:32 / 221
Layer: 1 of 1
Time: 0:09:32
Phase: Stopped
Time: 0:00:00 / 0:00:20
99%
Process Edit
AlProcess
Rename
New
Delete
Copy
Layer Out Film SetPt Thickness
1 1 Al Film 2 5 200
Cut Layer
Copy Layer
Paste Layer
Paste toDep
Layer RatePlramps Deposit Condition Source/Sensor Error
Film
Output
Input
AlFilm
Output 1
Sensor(s)
SetPt
Final Thick
Thick EndPt
Time EndPt
System Setup
2.00
5.000
0.000
0.00
Default
A/s
kA
kA
Sec.
Start Mode
Manual Start
Indexes
Source
Substrate
User1
User2
None
None
None
None
Index
Index
Index
Index
1000
800
600
400
200
0.0
0
10
20
30
40
50
Elapsed Time (sec.)
Film Rate(A/s) Dev.(%) Thick(kA) Power(%)
Cr Film 0.00 0.0 0.0405 0.0

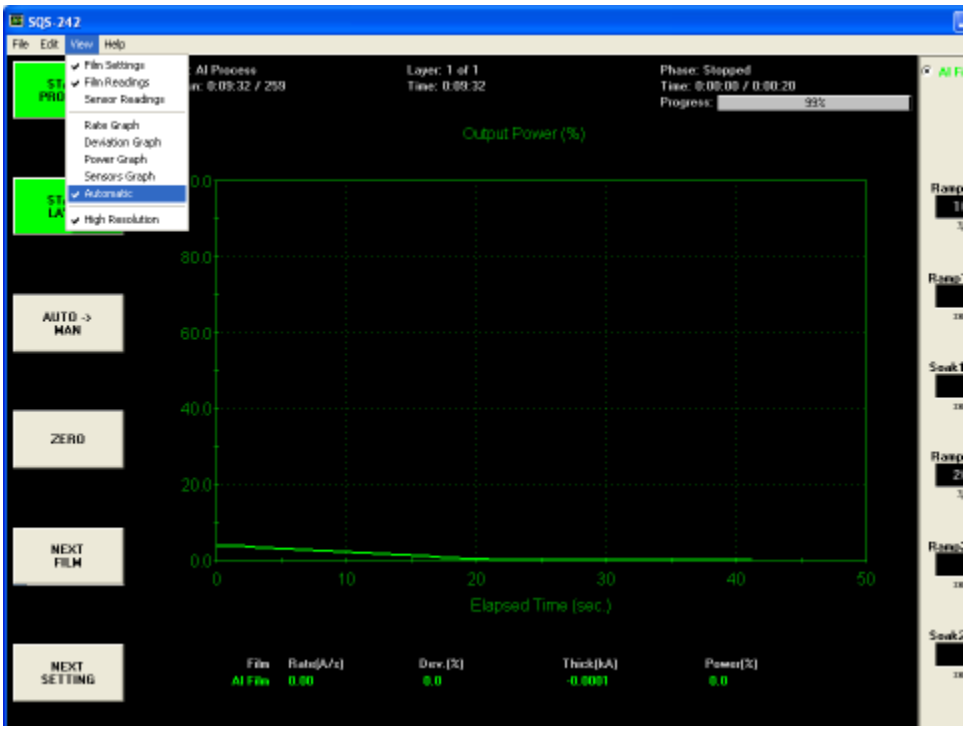

SQS-242
File Edit View Help
CLOSE FORM
SELECT LAYER
Process: Cr Process
Time/Run: 0:09:32 / 221
Layer: 1 of 1
Time: 0:09:32
Phase: Stopped
Time: 0:00:00 / 0:00:20
99%
Process Edit
AlProcess
Rename
New
Delete
Copy
Layer Out
Film
SetPt
Thickness
1 1 Al Film 2 5 200
Cut Layer
Copy Layer
Paste Layer
Paste toDep
Layer
RateRamps
Deposit
Condition
Source/Sensor
Error
Loop
P Term
I Term
0.2
Sec.
D Term
0.10
Sec.
Shutter Delay
Enabled
Accuracy
30.0
%
Wait
600.00
Sec.
Hold
20.00
Sec.
Rate Sampling
Continuous
Accuracy Based
5.00
%
Time Based
Sample
10.00
Sec.
Hold
10.00
Sec.
1000
800
600
400
200
0.0
0
10
20
30
40
50
Elapsed Time (sec.)
Go to Deposit tab to view/change Shutter Delay settings
Film
Rate(A/s)
Dev.(%)
Thick(kA)
Power(%)
Cr Film
0.00
0.0
0.0401
0.0
Ramp
Soak1
Soak2

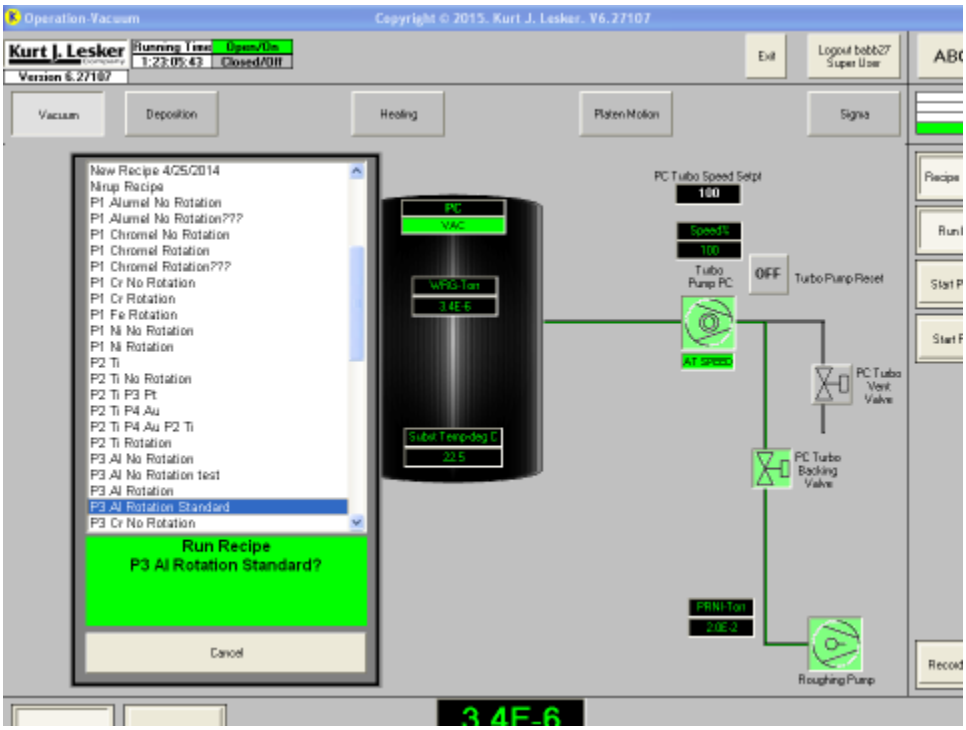

SQS-242
File Edit View Help
CLOSE FORM
SELECT LAYER
Process: Cr Process
Time/Run: 0:09:32 / 221
Layer: 1 of 1
Time: 0:09:32
Phase: Stopped
Time: 0:00:00 / 0:00:20
99%
Process Edit
AlProcess
Rename
New
Delete
Copy
Layer Out
Film
SetPt
Thickness
1 1 Al Film 2 5 200
Cut Layer
Copy Layer
Paste Layer
Paste toDep
Layer
RateRamps
Deposit
Condition
Source/Sensor
Error
Pre Condition
Ramp1 Pwr
10.00
%
Ramp2 Pwr
20.00
%
Auto
Ramp1 Time
45.00
Sec.
Ramp2 Time
60.00
Sec.
Soak1 Time
60.00
Sec.
Soak2 Time
180.00
Sec.
Post Condition
Feed Power
0.00
%
Idle Power
0.00
%
Ramp Time
200.00
Sec.
Ramp Time
60.00
Sec.
Feed Time
0.00
Sec.
1000
800
600
400
200
0.0
0
10
20
30
40
50
Elapsed Time (sec.)
Go to Condition tab to view/modify Pre and Post Ramping Conditions
Film
Rate(A/s)
Dev.(%)
Thick(kA)
Power(%)
Cr Film
0.00
0.0
0.0400
0.0
Ramp
Soak1
Soak2


SQS-242
CLOSE FORM
SELECT LAYER
Process Edit
Go to Source/Sensor tab to note down Sensor Tooling in logbook
Elapsed Time (sec.)


SQS-242
CLOSE FORM
SELECT LAYER
Process Edit
Change Process
Do you want to change the Operating Process to Al Process ?
Yes
No
Click Yes to change/save to the new metal deposition process
Elapsed Time (sec.)


SQS-242
File Edit View Help
Film Settings
Film Readings
Sensor Readings
Rate Graph
Deviation Graph
Power Graph
Sensors Graph
Automatic
High Resolution
Al Process
Layer: 1 of 1
Phase: Stopped
Progress:
99%
Output Power (%)
AUTO -> MAN
ZERO
NEXT FILM
NEXT SETTING
Elapsed Time (sec.)
Film
Rate(A/s)
Dev.(%)
Thick(kA)
Power(%)
Al Film


SQS-242
File Edit View Help
Film Settings
Film Readings
Sensor Readings
Rate Graph
Deviation Graph
Power Graph
Sensors Graph
Automatic
High Resolution
Al Process
Layer: 1 of 1
Phase: Stopped
Progress:
99%
Output Power (%)
AUTO -> MAN
ZERO
NEXT FILM
NEXT SETTING
Elapsed Time (sec.)
Film
Rate(A/s)
Dev.(%)
Thick(kA)
Power(%)
Al Film


Operation-Vacuum
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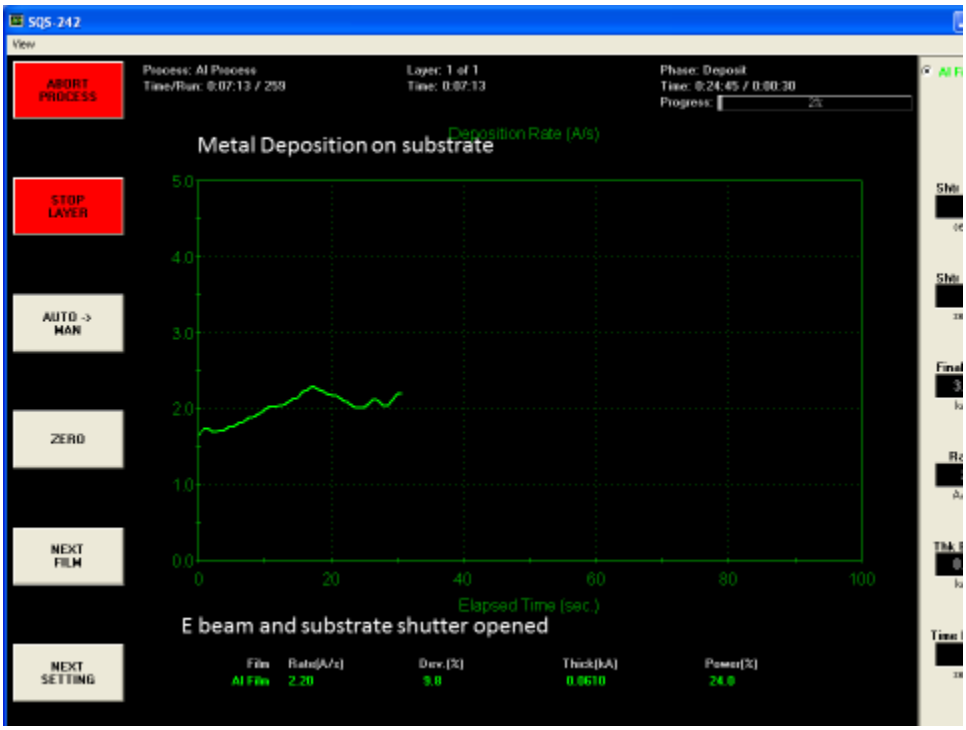
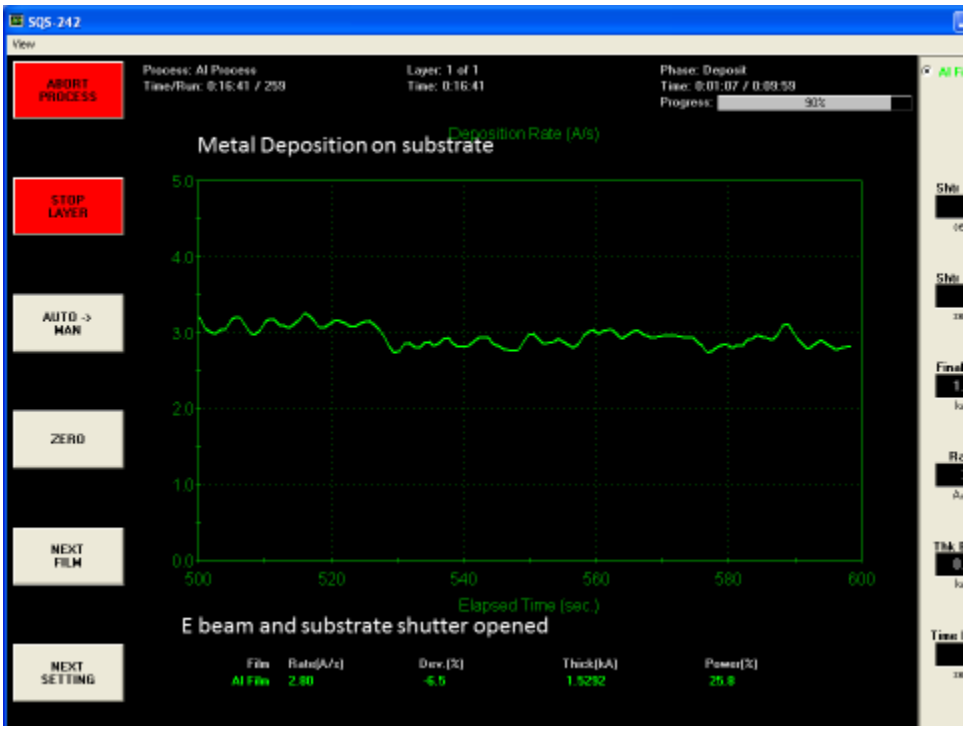
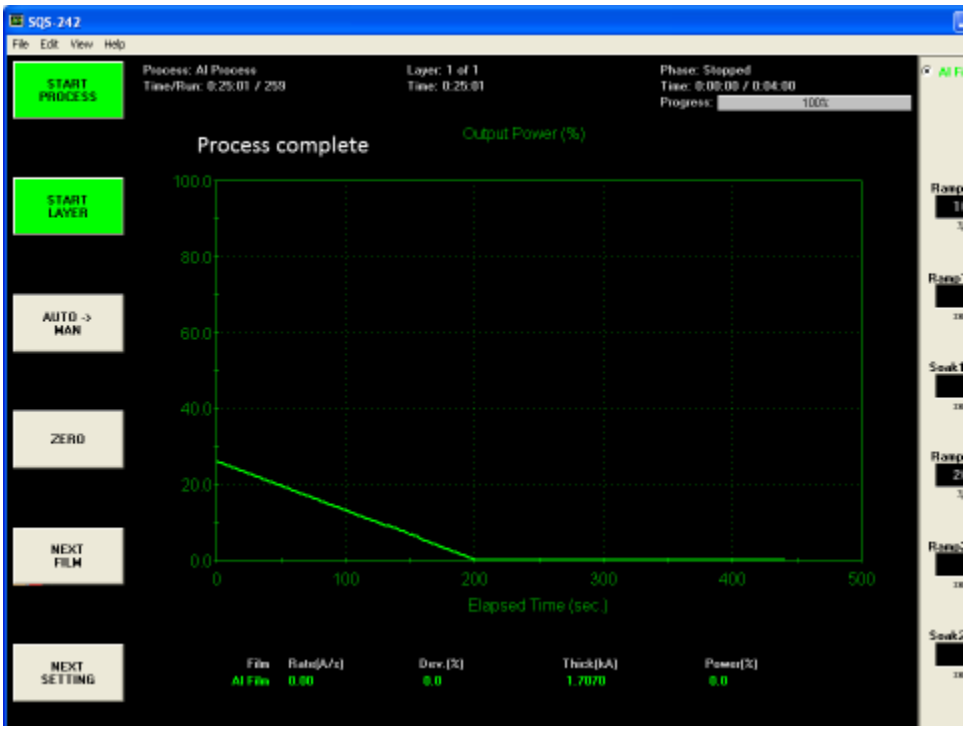
Kurt J. Lesker
Version 6.27107
Exit
Vacuum
Deposition
Heating
Platen Motion
Sigma
New Recipe 4/25/2014
Nirup Recipe
P1 Alumel No Rotation
P1 Alumel No Rotation???
P1 Chromel No Rotation
P1 Chromel Rotation
P1 Chromel Rotation???
P1 Cr No Rotation
P1 Cr Rotation
P1 Fe Rotation
P1 Ni No Rotation
P1 Ni Rotation
P2 Ti
P2 Ti No Rotation
P2 Ti P3 Pt
P2 Ti P4 Au
P2 Ti P4 Au P2 Ti
P2 Ti Rotation
P3 Al No Rotation
P3 Al No Rotation test
P3 Al Rotation
P3 Al Rotation Standard
P3 Cr No Rotation
Run Recipe
P3 Al Rotation Standard?
Cancel
PC Turbo Speed Setpt
100
Speed%
100
Turbo Pump PC
OFF
Turbo Pump Reset
AT SPEED
PC Turbo Vent Valve
PC Turbo Backing Valve
Roughing Pump
3.4E-6

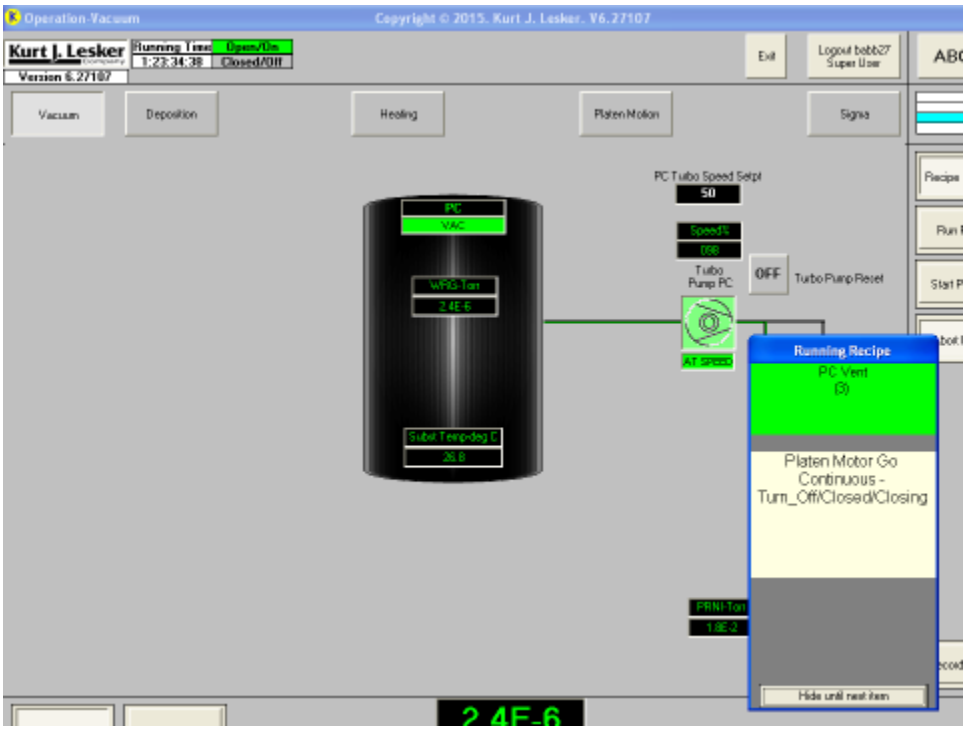

SQS-242
View
ABORT PROCESS
Process: Al Process
Time/Run: 0:04:38 / 259
Layer: 1 of 1
Time: 0:04:38
Phase: Soak 2
Time: 0:01:07 / 0:04:38
Progress:
80%
Pre condition Ramping
Output Power (%)
STOP LAYER
AUTO -> MAN
ZERO
NEXT FILM
NEXT SETTING
100.0
80.0
60.0
40.0
20.0
0.0
0
100
200
300
400
500
Elapsed Time (sec)
E beam and substrate shutter closed
Film
Rate(A/s)
Dev (%)
Thick(kA)
Power(%)
Al Film
0.00
-100.0
-0.0002
20.0


SQS-242
View
ABORT PROCESS
Process: Al Process
Time/Run: 0:07:13 / 259
Layer: 1 of 1
Time: 0:07:13
Phase: Deposit
Time: 0:24:45 / 0:00:30
Progress:
Deposition Rate (A/s)
Metal Deposition on substrate
STOP LAYER
AUTO -> MAN
ZERO
NEXT FILM
NEXT SETTING
5.0
4.0
3.0
2.0
1.0
0.0
0
20
40
60
80
100
Elapsed Time (sec.)
E beam and substrate shutter opened
Film
Rate(A/s)
Dev.(%)
Thick(kA)
Power(%)
Al Film
2.20
9.0
0.0610
24.0


SQS-242
View
ABORT PROCESS
Process: Al Process
Time/Run: 0:16:41 / 259
Layer: 1 of 1
Time: 0:16:41
Phase: Deposit
Time: 0:01:07 / 0:09:59
Progress: 90%
Deposition Rate (A/s)
Metal Deposition on substrate
STOP LAYER
AUTO -> MAN
ZERO
NEXT FILM
NEXT SETTING
5.0
4.0
3.0
2.0
1.0
0.0
500
520
540
560
580
600
Elapsed Time (sec.)
E beam and substrate shutter opened
Film
Rate(A/s)
Dev.(%)
Thick(kA)
Power(%)
Al Film
2.80
-6.5
1.5292
25.8


SQS-242
View
ABORT PROCESS
Process: Al Process
Time/Run: 0:23:30 / 259
Layer: 1 of 1
Time: 0:23:30
Phase: Idle Ramp
Time: 0:01:31 / 0:02:29
Progress:
79%
Post Condition Ramp down
Output Power (%)
STOP LAYER
AUTO -> MAN
ZERO
NEXT FILM
NEXT SETTING
1000
800
600
400
200
0
0
100
200
300
400
500
Elapsed Time (sec)
E beam and substrate shutter closed
Film
Rate(A/s)
Dev.(%)
Thick(kA)
Power(%)
Al Film
-0.01
-100.4
1.7073
0.0


SQS-242
File Edit View Help
START PROCESS
Process: Al Process
Time/Run: 0:25:01 / 259
Layer: 1 of 1
Time: 0:25:01
Phase: Stopped
Time: 0:00:00 / 0:04:00
Progress:
100%
Process complete
Output Power (%)
START LAYER
AUTO -> MAN
ZERO
NEXT FILM
NEXT SETTING
1000
800
600
400
200
0
0
100
200
300
400
500
Elapsed Time (sec)
Film
Rate(A/s)
Dev.(%)
Thick(kA)
Power(%)
Al Film
0.00
0.0
1.7070
0.0


Operation-Vacuum
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Kurt J. Lesker
Version 6.27107
Exit
Vacuum
Deposition
Heating
Platen Motion
Sigma
PC Turbo Speed Setpt
50
Turbo Pump PC
OFF
Turbo Pump Reset
AT SPEED
Running Recipe
PC Vent
(3)
Platen Motor Go Continuous - Turn_Off/Closed/Closing
Hide until next item
2.4E-6