University of Minnesota Minnesota Nano Center
Standard Operating Procedure

Equipment Name: CHA Evaporator

Badger Name:	P3 EvaporatorCHA	**Rev. Number:**	15
Model:	SEC 600	**Revisionist**:	L. von Dissen
Location:	PAN Bay 3	**Date:**	03/25/2020

1 Description

The CHA Evaporator is a single source electron beam evaporator. It has a lift-off fixture and a planetary fixture for 4” wafers. It can run up to six different materials in a run. The lift-off fixture holds 9 wafers, and the planetary fixture holds 6 wafers each; since there are 3 planetary fixtures that can be used, a total of 18 wafers can be run at one time.

Note: For users that desire to run 6” wafers, MNC has a fixture available which can accommodate up to three 6” wafers at once. Ask appropriate MNC staff for details.

2 Safety

- **a.** Use the dark tinted, welder's glass provided when looking directly at the beam if it is too bright, or alternatively you can use tinted safety glasses.
- **b.** Take care when loading wafers and crucibles. Use a step stool if needed.
- **c.** The crucibles may be hot when unloading. Be careful when handling.

3 Restrictions/Requirements

- **a.** **DO NOT** leave the system during deposition for more than 10 minutes at a time and **ONLY** after the beam is verified to be in the pocket.
- **b.** During a FIRE or lab GAS alarm press **F12** on the SEIMENS computer to abort a run if the system is running. You can also press the **STOP** button on the Inficon computer to stop the process. The red **EMO** button should only be pressed if there is obvious danger such as fire, smoke, or a water leak.
- **c.** **Materials are restricted to those listed on the CHA Material Parameters Sheet located in the CHA Log Book. See Staff for approval of other materials.**
- **d.** **The first 3 pockets are dedicated to Aluminum, Cobalt, and Gold.**
- **e.** **Do not put scotch tape in the CHA! Only use “Kapton” (polyimide) tape**

4 Required Facilities

- **a.** Compressed air 80-90 psi
- **b.** Process water
- **c.** Nitrogen gas
- **d.** Electrical 208/240 VAC
- **e.** House Exhaust

5 Definitions

a. **INFICON (IC6):** The computer where recipes are written and stored.

b. **SEIMENS:** The computer that is the operator interface. It is controlled by the keyboard and mouse pad as well as the touch panel surrounding the monitor. It has a picture of the bell jar as well as all the fixturing and major valves within the system. Buttons that are displayed are used to operate the system.

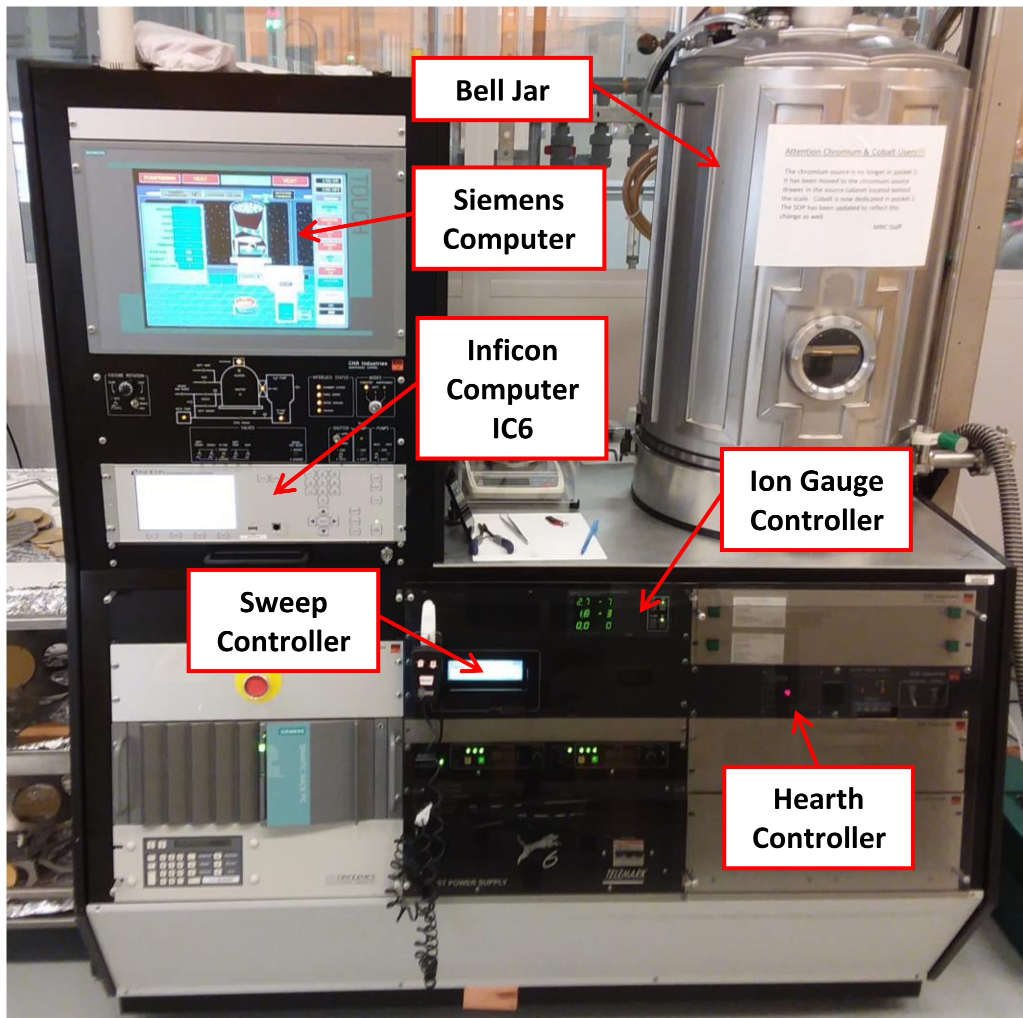
c. **Gun:** This refers to the copper hearth that holds several metals to be evaporated.

d. **Crucible:** This is a name used to describe each "gun" position (1 through 6).

e. **Pocket**: This is another name used to describe each "gun" position (1 through 6).

f. **Crystal / QCM**: This is the deposition monitoring crystal (QCM: Quartz Crystal Microbalance) which is used to monitor the deposition rate and thickness of the depositing film.

g. **Equipment Overview:**



6 Setup

a. Enable the CHA with the Badger system.

7 Operating Instructions

a. VENT THE CHA

1. If the system has been pumping down for a while, and the pressure in the main chamber is at or below Torr, a window will be on the screen that says "PUMPDOWN COMPLETE".

If this "PUMPDOWN COMPLETE" message is not on the screen, then there should be a blue banner that reads:

"IG2 SETPOINT 1 IS BEING MADE"

In either case, to vent the system, press **F4** to go into standby. Click **"OK"** (or press **A**) to acknowledge the standby message when it appears.

2. Press **F3 (VENT)** to begin venting the CHA. The chamber animation on the screen will gradually fill up with a blue/green color indicating that the system is venting.

3. When the system has vented, a window will pop up saying that the vent cycle has completed. Left click on the "**RETURN TO STANDBY"** button (or press **A**). Wait about 10 seconds, and then click "**OK**" (or press **A**) when the "**SYSTEM IN STANDBY"** message appears.

4. An option will appear on the screen allowing you to raise the bell jar:

BELL JAR UP
F5

Press and hold **F5** to raise the bell jar. Keep holding/pressing **F5** until the bell jar is all the way up (it will stop moving when it is all the way up).

5. When the bell jar has moved up, the "**BELL JAR DOWN**" option pops up, which will be used after you are finished loading/unloading the chamber.

BELL JAR DOWN **F4**

b. LOAD SAMPLES

1. With the bell jar open, load wafers onto the LIFT-OFF dome. Secure the wafers / holders to the dome with the clips. Fill any empty spots on the dome with samples holders. If using the PLANETARY fixture, the PLANETS should be loaded **before** hanging them on the planet pole fixture, and the load should be evenly distributed around the planet (i.e. equal spacing and weight distribution of wafers if possible).

c. LOAD SOURCE MATERIAL – POCKETS

1. The CHA has 6 pockets in the gun. The first 3 pockets have been dedicated to particular materials. **These dedicated pockets should always have the dedicated materials in them.** Verify that those dedicated materials are in the CHA if you are going to use them during your run. If the aluminum or chromium sources look low, there should be aluminum and chromium pellets in the cabinet to the left of the bell jar in their own labeled drawers. Place a couple of pellets in the appropriate pocket if needed (do not overfill beyond the height of the pocket). Contact an MNC staff member if you need help refilling or replacing any material.
   Pocket 1: Solid Aluminum (no liner)
   Pocket 2: Cobalt (no liner)
   Pocket 3: Gold (Tungsten liner with two buttons underneath)
   Pocket 4-6: Open for use, and can be loaded with any of the allowed materials.

2. Press **F7** to open the scissor shutter in order to access the various pockets and metal sources in the hearth.

3. Every user must weigh the gold source (and the two buttons that normally lay underneath this gold source) before any run is performed. Press **F6** to rotate the gun to a different pocket. A window will pop up with different pocket numbers. Since the gold source is dedicated in pocket 3, select pocket 3 by pressing the number 3 on the keyboard/keypad or by clicking on "Pocket 3" on the Siemens computer screen using the mouse/track-pad. The gun will slowly rotate to the pocket you selected.

4. Turn on the scale located to the left of the bell jar. Remove the gold source (and the two buttons that are underneath the gold source) from pocket 3 and place it on the scale. Record the combined weight of the gold source and the two buttons in the CHA log book. Place the two buttons back in to the center of pocket 3. Place the gold source back on top of the buttons in the center of pocket 3. If you plan to use platinum or palladium, weigh those sources as well and then record those weights in the log book (record the combined weight of the metal source and the two buttons).

5. If you plan to load or evaporate materials from other pockets in the gun, select those pockets on the Siemens computer screen and physically load them with the desired materials as needed. Left click on **DONE** (or press **A**) when finished loading all desired pockets.

6. Check the status/percent-life of the deposition monitoring crystal (QCM) on the **IC6 Deposition Controller**. To do this, from the main "Operate" screen, press the **MENU** button (located below the numerical keypad) to access the Main Menu (if you are not already in the Main Menu). See the image below which shows the Main Menu:

0.00Å/s 0.000kÅ 0.00% READY

Operate	General
Sensor Information	Digital I/O
Sensor	Logic
Source	Maintenance
Material	Counter/Timer
Process	USB Storage

Main Menu
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Use the **arrow keys** to move the cursor to select the **"Sensor Information"** screen. Once this screen option has been selected, press the **MENU** button to enter this screen (see image on next page).

0.00 Å/s 0.000 kÅ 0.00 % READY

	Sensor	Average Rate	Raw Rate	% Life	Crystal Curr	Next	Failed	Q Count	S Single	S Total
Rate/Xtal	1	0.000	0.000	0	1	2		N/A	N/A	N/A
Type/Freq	2	N/A	N/A	0				N/A	N/A	N/A

Sensor Information

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Switch Crystal	Rotate Sensor	Clear S & Q Counts	Clear Failed Crystals

Although there are two deposition monitoring QCM crystals available for use on the system, the IC6 controller labels them as a single sensor (Sensor #1, containing both crystal #1 and crystal #2). To determine which crystal is currently selected, look under the column labeled **“Curr”** (an abbreviation for “Current”) and see which number is listed (1 or 2). <u>You will not be able to see this column</u> unless you are on the **“Rate/Xtal”** page of this **“Sensor Information”** screen. If you are not on the **“Rate/Xtal”** page of this screen, use the **arrow keys** on the IC6 to move the cursor to the far left column to select the **“Rate/Xtal”** page.

In the column labeled **“% Life”**, you will be able to see how much crystal life has been spent. This is a quality metric for the crystal which INCREASES over time as the crystal is coated with evaporated material and loses sensitivity. When the crystal life reaches 15 (%) or higher, it is generally changed at that time. Once you’re finished looking at the “% Life” of the crystal, use the **arrow keys** to move the cursor to the far left column to select the **“Type/Freq”** page on this screen. Look at the first row of information pertaining to “Sensor 1” and under the column labeled **“Act”** (an abbreviation for “Activity”) you will see a number corresponding to the current crystal’s activity. This is another quality metric for the crystal which tends to DECREASE over time.

If the crystal “% Life” is greater than or equal to “15”, or if the crystal “Activity” is less than or equal to “600”, replace the QCM crystal. Change the QCM crystal as instructed by MNC staff (or ask MNC staff for assistance). If you end up installing a new crystal, be sure to double-check both the “% Life” and “Activity” values just to make sure it was installed properly. Once you are finished checking these values, press the **MENU** button to return to the Main Menu.

7. Look in the bottom mirror of the periscope assembly to make sure that the pocket in the gun is visible in the reflection off the mirror. You want to do this to ensure that you can see the pocket with this mirror before closing the chamber and pumping down as the pocket visibility is critical once the e-beam is turned on.

8. Check the chamber's internal hardware for peeling/flaking metal and inform MNC staff if there is a significant amount of build-up. The most important areas to check for metal peeling/flaking are the bottom of the scissor shutter and the area surrounding the pockets themselves. If the shutters or pockets are peeling/flaking, ask MNC staff for assistance so the shutters can be changed out and/or so the pockets can be quickly cleaned prior to pumping the system down. Peeling/flaking metal can contaminate the metal sources, so any cleaning needed must be taken care of BEFORE pumping the system down and running a deposition.

9. Press **F7** to close the scissor shutter.

10. Press and hold **F4** to lower the bell jar. Keep holding/pressing **F4** until the bell jar is all the way down and stops moving.

d. Run Recipe in Automatic

1. Press **F2** (**PUMPDOWN**) to start the pump-down sequence. The chamber will pump down trying to reach the setpoint of **Torr.** Once this pressure is reached, the system will continue to pump, but you will now have the option to start your run. When this pressure has been reached, the following message will appear:

2. While you are waiting for the pumpdown to complete, you can program your recipe in the Inficon computer (IC6 Deposition Controller).

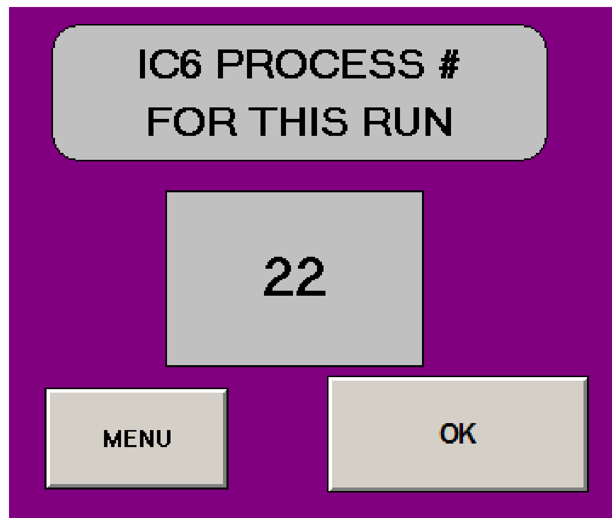
   See the "Appendix: IC6 Recipe Writing" on page 11 for instructions on how to program your process recipe.

3. Zero out the X and Y offsets on the MDC sweep controller for a safe initial beam position. The Program button, '**PRM**', should already be highlighted (if not, press PRM). The beam position can be adjusted by pressing the corresponding X or Y axis button on the MDC sweep controller. Use the hand controller to adjust the X and Y offsets as needed during the run. For now, adjust them both to 0.0

When the pumpdown has completed and you are ready to start, first make sure that all four interlock conditions have been met. You can verify this by checking to see that all four "Interlock Status" LEDs (located below the computer monitor) are lit. If any of them are not lit, please report a problem in Badger and do not use the tool.

4. Press **F1** (**Automatic**) to start an automatic process run. If a lower pressure is desired, wait until that pressure has been reached before pressing F1.

5. A window will pop up asking for the IC6 process number that you want to run.



6. Click on the number shown and a window will pop up where you can enter your desired process number. After you type in the desired process number click OK or press Enter to close the window. Next, click the OK button on the purple pop-up window to start the process.

The gun turret should rotate to the correct pocket. Check to confirm that the pocket number is correct by looking at the “Hearth Controller” which is located to the right of the “Sweep Controller”, below the bell jar. There should be a red digital number displayed (1 through 6).

7. Observe the beam inside the chamber. If it is too bright, use UV protective glasses or a piece of tinted glass (located on the CHA metal supply cabinet. The Program button ‘**PRM**’ should already be highlighted (if not, press **PRM**). Adjust the beam position as needed using the MDC sweep controller. The beam can be adjusted by pressing the corresponding X or Y axis button on the MDC sweep controller. Use the hand controller to adjust the beam by pressing the up or down arrow buttons. Be sure to look inside the chamber at the beam while you are changing the X or Y axis settings to determine where the beam is moving.

8. When the target thickness has been reached, the shutter will close automatically and the beam will shut off. A message will pop up asking if you want to vent the chamber. Wait at least 10 more minutes for the sources to cool before venting.

   After you are finished cooling the metal source, vent the chamber by left clicking on **YES** or pressing **F9**. When the system is vented, a message will pop up saying “PROCESS COMPLETE”. Press **F4** (or press **A**) to enter standby. Wait about 10 seconds, and then click “**OK**” (or press **A**) when the **SYSTEM IN STANDBY** message appears. Press and hold **F5** to raise the bell jar, and then unload your wafers.

9. If you loaded any sources in to pockets 4, 5, or 6, remove them from the system. To do this, press **F7** to open the scissor shutter. Then press **F6** to rotate the gun to a different pocket. A window will pop up with different pocket numbers. Select the desired pocket(s) by pressing the appropriate number on the keypad or by clicking on the desired pocket number on the Siemens computer screen using the mouse/track-pad. The gun will slowly rotate to the pocket you selected.

   Note: If you used the gold source during your run (or platinum or palladium), you need to weigh the precious metal source (and the two buttons) one more time before closing the bell jar. Record these weights in the CHA log book.

e. Idle State: The CHA is ALWAYS to be left pumped down.

1. Press and hold **F4** to lower the bell jar. Keep holding/pressing **F4** until the bell jar is all the way down and stops moving. Then press **F2** (**PUMPDOWN**) to pump the system back down. The system will do a soft roughing pump-down for 1-2 minutes, and then it will switch to a regular roughing pump-down for several minutes. The chamber animation on the screen will gradually change from green to gray indicating that it is pumping. When the cross-over pressure setpoint is reached, the roughing valve will close automatically and the system will then measure the "rate of rise" (i.e. leak-up rate). If the system is satisfied with the "rate of rise" test, it will automatically cross over into high vacuum and you will hear the high vacuum valve open.

2. Stay with the system until **"IG2 SETPOINT 1 IS BEING MADE"** is displayed on the screen. (If this does not happen within 10 minutes after starting the pump-down, contact an MNC staff member). After this, you can disable the CHA in the Badger system. If you did use the gold source during the run, you will need to calculate how much gold you used (in milligrams). An example is listed in the table at the top of the next page.

Beginning Weight	172.53 grams
Ending Weight	170.41 grams
Total Gold Used (in milligrams)	2.12 grams = **2120 milligrams**

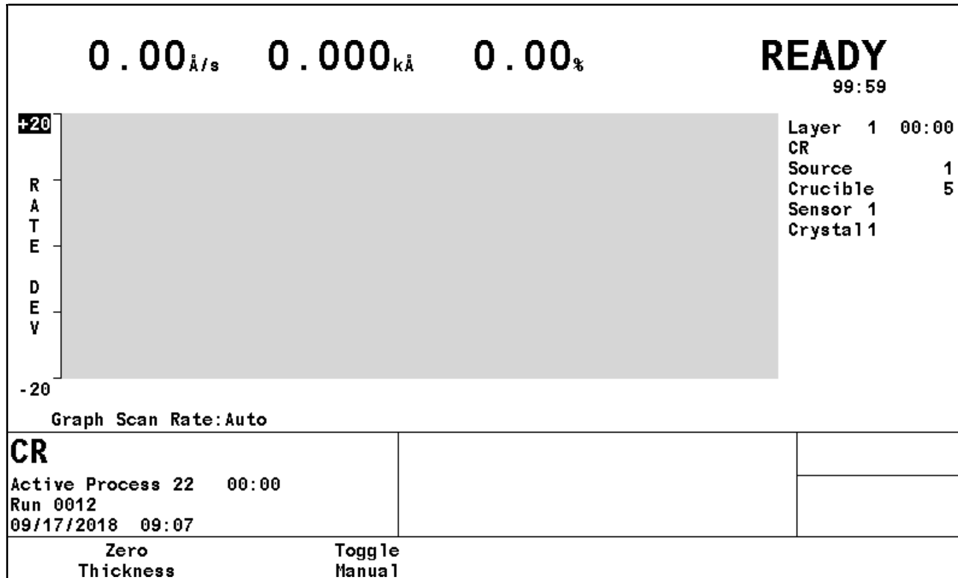
In Badger, click on the **"Supplies"** menu, and select **"Check Out".** You will then notice a supply list that appears on the left side within the Badger window. Scroll down the list and click on "evap gold" (or "evap platinum" or **"evap palladium"** if those were used). Then you will see that supply name appear in the **"Supply"** field box. In the **"Quantity"** field box, enter the number of milligrams of gold (or Pt or Pd) that was used (which was 2120 mg in the example above). Click on **"Save & Close".**

3. Finish filling out the log book (e.g. your name, the date, your materials, pocket numbers, deposition rates, thicknesses, percent crystal life, etc.). If you used any precious metals (Au, Pd, or Pt), please be sure to record the beginning and ending weights for these sources in the CHA log book.

8. Appendix: IC6 Recipe Writing

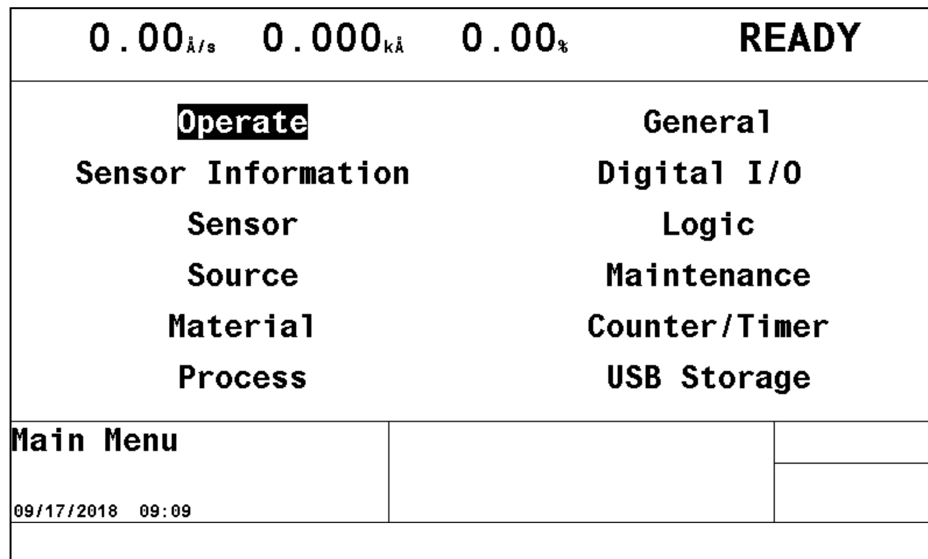
a. WRITING A PROCESS RECIPE (INIFICON COMPUTER)

1. Shown below is the INFICON main **“Operate”** screen. This is the screen that you will most likely encounter when you first approach the system.



b. Programming Materials

1. Selecting Materials: From the main **“Operate”** screen (which looks like the image shown above), press the **MENU** button (located below the numerical keypad) in order to access the Main Menu. The **“Main Menu”** screen will look like the following (see below):



Use the **arrow keys** on the IC6 to move the cursor to the **“Material”** screen option. Once this screen option has been selected, press the **MENU** button to enter this screen. You may notice that this screen, by default, shows whichever material page was last accessed by the previous user (which, in the image shown below, happens to be the **“Deposit”** page of the **“Material”** screen for aluminum):

-0.00 Å/s 0.000 kÅ 0.00 % READY

Menu	Setting	Value	Unit	Setting	Value	Unit
Overview	Material Number	1				
Source	Rate	0.100	Å/s	Ramp 1 Rate	0.000	Å/s
Sensor	Time Limit	00:00	mm:ss	Start Ramp 1	0.000	kÅ
Pre/Post	Rate Filter Time	One Tenth	s	Ramp 1 Time	00:00	mm:ss
Deposit	Time Power Avg Time	0	Min	Ramp 2 Rate	0.000	Å/s
Lib A-Hf	Ion Assist Deposit	No		Start Ramp 2	0.000	kÅ
Lib Hf-Sc	On Final Thickness	Post-Dep		Ramp 2 Time	00:00	mm:ss
Lib Sc-Z				RateWatcher Option	No	
				Time	00:00	mm:ss
				Accuracy	5	%

AL
09/17/2018 09:13

Use the **arrow keys** on the IC6 and move the cursor to select the **“Overview”** page within this **“Material”** screen. On this page, you will see the list of materials that have been programmed into the IC6 for potential use in a process. See the image below:

-0.00 Å/s 0.000 kÅ 0.00 % READY

Menu				
Overview	1 AL	9 AU	17 FE	25 Material 25
Source	2 CR	10 AG	18 SN	26 Material 26
Sensor	3 NI	11 CU	19 SC	27 Material 27
Pre/Post	4 CO	12 MO	20 NI	28 Material 28
Deposit	5 TI	13 GE	21 CR	29 Material 29
Lib A-Hf	6 TI	14 NB	22 MO	30 Material 30
Lib Hf-Sc	7 PD	15 W	23 NIFEMO	31 Material 31
Lib Sc-Z	8 PT	16 TA	24 MN	32 Material 32

AL
09/17/2018 09:14

Select Material | Copy Material | Paste Material | Default Material

Use the **arrow keys** on the IC6 and move the cursor to the first material you plan to program into your process. Once you have your first process layer material number highlighted, press the **F1 button** ("Select Material") on the IC6 controller (located below the IC6 monitor) to select your first material. In the example shown below, material number 1 was selected ("1 AL") which corresponds to aluminum.

-0.00 Å/s 0.000 kÅ 0.00 % READY

Overview
Source
Sensor
Pre/Post
Deposit
Lib A-Hf
Lib Hf-Sc
Lib Sc-Z

Material Number 1
Name AL
Density 2.700 g/cc
Z-Ratio 1.080
Control Loop NonPID
Process Gain 10.000 Å/s/%
Time Constant 1.000 s
Dead Time 1.000 s

Source 1
Maximum Power 50.00 %
Max Power Option Continue
Minimum Power 0.00 %
Recorder Output 0
Recorder Function Rate
Recorder Range 100

AL
09/17/2018 09:16

3. Modifying the Material Parameters**:** The only parameter you should have to check (and possibly modify) on this page is the "Maximum Power". Please consult the CHA **Material Parameters Sheet** to verify what this value should be. If you need to change the value for any parameter, use the **arrow keys** to move the cursor to the desired parameter, and then use the alpha-numeric keypad to enter the new value and then press the **ENTER** button to save the changes made to that parameter.

   Use the **arrow keys** on the IC6 and move the cursor to select the **"Pre/Post"** page within this **"Material"** screen. This page of the **"Material"** screen is where all of the pre-deposition parameters are stored for this particular material (see image on next page). Please consult the CHA **Material Parameters Sheet** to verify that the following parameters are set properly:

Rise Time 1	Rise Time 2	Feed Ramp Time
Soak Power 1	Soak Power 2	Idle Ramp Time
Soak Time 1	Soak Time 2	

```
-0.00 Å/s   0.000 kÅ   0.00 %          READY

Overview   Material Number            1
Source     PreCon Rise Time       00:00  mm:ss   Delay Option             None
Sensor     PreCon Soak Power       0.00  %       Control Delay Time      00:00  mm:ss
Pre/Post   PreCon Soak Time       00:00  mm:ss   Shutter Delay Accur         5  %
Deposit    Rise Time 1            01:00  mm:ss   Transfer Sensor             0
Lib A-Hf   Soak Power 1           22.00  %       Transfer Tooling        100.0  %
Lib Hf-Sc  Soak Time 1            01:00  mm:ss   Feed Ramp Time          00:30  mm:ss
Lib Sc-Z   Rise Time 2            01:00  mm:ss   Feed Power               0.00  %
           Soak Power 2           26.00  %       Feed Time               00:00  mm:ss
           Soak Time 2            01:00  mm:ss   Idle Ramp Time          05:00  mm:ss
           Auto Soak 2               No          Idle Power               0.00  %
           Dep After Pre-Dep        Yes
AL
09/17/2018  09:18
```

Use the **arrow keys** on the IC6 and move the cursor to select the **"Deposit"** page within this **"Material"** screen. This page of the **"Material"** screen is where you will need to program your deposition rate **("Rate"**) for this particular material in your process. Enter your desired deposition rate here and then press the **ENTER** button to save this value (see image below).

```
-0.00 Å/s   0.000 kÅ   0.00 %          READY

Overview   Material Number            1
Source     Rate                   0.100  Å/s     Ramp 1 Rate             0.000  Å/s
Sensor     Time Limit             00:00  mm:ss   Start Ramp 1            0.000  kÅ
Pre/Post   Rate Filter Time   One Tenth  s       Ramp 1 Time             00:00  mm:ss
Deposit    Time Power Avg Time        0  Min     Ramp 2 Rate             0.000  Å/s
Lib A-Hf   Ion Assist Deposit        No          Start Ramp 2            0.000  kÅ
Lib Hf-Sc  On Final Thickness  Post-Dep          Ramp 2 Time             00:00  mm:ss
Lib Sc-Z                                         RateWatcher
                                                  Option                    No
                                                  Time                   00:00  mm:ss
                                                  Accuracy                   5  %
AL
09/17/2018  09:19
```

If you need to program additional materials in your process, go back to the middle of page 12 in this SOP and repeat those programming steps as needed until you are finished programming all desired materials. When you are finished programming all of the materials needed for your process, go back to the Main Menu by pressing the **MENU** button.

c. Programming Processes

1. <u>Selecting a Process</u>: From the Main Menu, use the **arrow keys** on the IC6 to move the cursor to the **"Process"** screen option. Once this screen option has been selected, press the **MENU** button to enter this screen. You may notice that this screen, by default, shows whichever process page was last accessed by the previous user (which, in the image shown below, happens to be the **"1 – 10"** page of the **"Process"** screen for Process Number 22).

-0.00 Å/s 0.000 kÅ 0.00 % READY

Overview

Curr Proc

1 - 10

Process Number 22 Layers Defined 1
Name CR

Layer	Material # Name	Final Thick	Thick Limit	Cruc	CoDep	Ratio Cntrl	Cal Stat	Cross Talk
1	2 CR	0.050	0.000	4	No	0.0		
2								

CR
Active Process 22
09/17/2018 09:22

Tag Layer | Insert Layer | Delete Layer | UnTag Layer

Whichever process was last viewed will be the default process shown on this **"Process"** screen. As seen in the image above, the process currently in view is process number 22 which is named "CR", and which consists of only one layer (Layer 1). In this case, the material for layer 1 is chromium, it has a thickness of 0.050 kÅ (50 angstroms), and the crucible number where this material is located is crucible # 4).

To select another process number, use the **arrow keys** on the IC6 and move the cursor to select the **"Overview"** page within this **"Process"** screen. On this page, you will see the list of processes that are available for programming. There are a total of 50 processes available (as seen in the image on the next page).

-0.00 Å/s 0.000 kÅ 0.00 % READY

Overview	1 > TEST	18 Process 18	35 Process 35
	2 > Process 2	19 Process 19	36 Process 36
	3 Process 3	20 Process 20	37 Process 37
Curr Proc	4 Process 4	21 Process 21	38 Process 38
	5 Process 5	22 > CR	39 Process 39
1 - 10	6 Process 6	23 Process 23	40 Process 40
	7 Process 7	24 Process 24	41 Process 41
	8 Process 8	25 Process 25	42 Process 42
	9 Process 9	26 Process 26	43 Process 43
	10 Process 10	27 Process 27	44 Process 44
	11 Process 11	28 Process 28	45 Process 45
	12 Process 12	29 Process 29	46 Process 46
	13 Process 13	30 Process 30	47 Process 47
	14 Process 14	31 Process 31	48 Process 48
	15 Process 15	32 Process 32	49 Process 49
	16 Process 16	33 Process 33	50 Process 50
	17 Process 17	34 Process 34	

CR
Active Process 22
09/17/2018 09:24

Select Process | Set Active Process | Default Process

Use the **arrow keys** on the IC6 and move the cursor to the desired process number. Once you have your desired process number highlighted, press the **F1 button** on the IC6 controller (located below the IC6 monitor) to select this process for further programming. In the example shown below, process number 22 was selected (“CR”).

-0.00 Å/s 0.000 kÅ 0.00 % READY

Overview

Curr Proc

1 - 10

Process Number 22 Layers Defined 1
Name CR

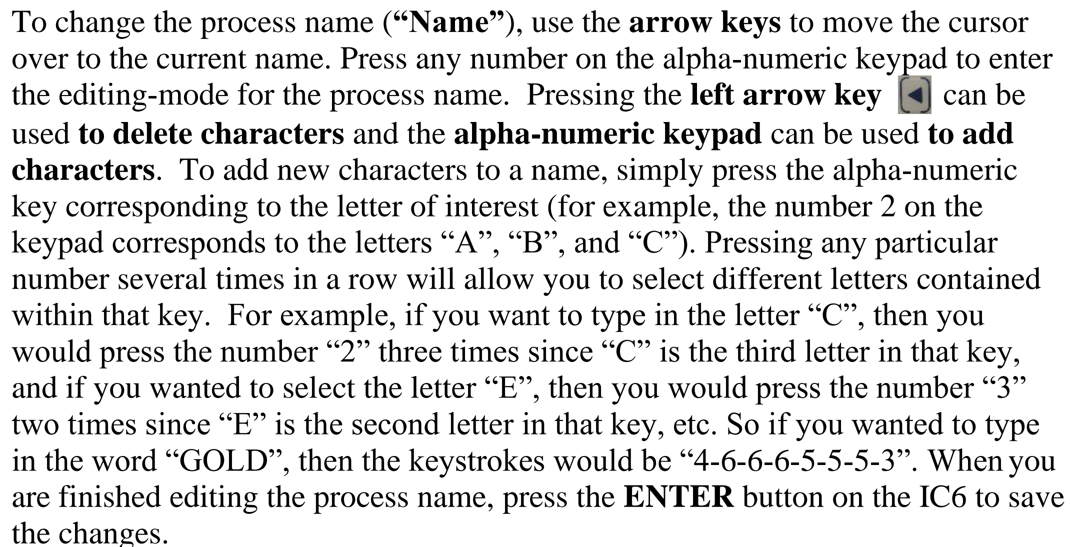
Layer	Material # Name	Final Thick	Thick Limit	Cruc	CoDep	Ratio Cntrl	Cal Stat	Cross Talk
1	2 CR	0.050	0.000	4	No	0.0		
2								

CR
Active Process 22
09/17/2018 09:22

Tag Layer | Insert Layer | Delete Layer | UnTag Layer

2. <u>Modifying the Process Parameters</u>**:** Use the **arrow keys** on the IC6 and move the cursor to the far left column in order to select the **"1 – 10"** page option on this process screen. Next, use the **arrow keys** to move the cursor to any parameter within your process that you want to edit. The following parameters can be edited as needed:

   - Process name **("Name")**
   - Material number (**"Material #")**
   - Final thickness (**"Final Thick")**
   - Crucible number (**"Cruc")**

   To change the process name (**"Name"**), use the **arrow keys** to move the cursor over to the current name. Press any number on the alpha-numeric keypad to enter the editing-mode for the process name. Pressing the **left arrow key**  can be used **to delete characters** and the **alpha-numeric keypad** can be used **to add characters**. To add new characters to a name, simply press the alpha-numeric key corresponding to the letter of interest (for example, the number 2 on the keypad corresponds to the letters "A", "B", and "C"). Pressing any particular number several times in a row will allow you to select different letters contained within that key. For example, if you want to type in the letter "C", then you would press the number "2" three times since "C" is the third letter in that key, and if you wanted to select the letter "E", then you would press the number "3" two times since "E" is the second letter in that key, etc. So if you wanted to type in the word "GOLD", then the keystrokes would be "4-6-6-6-5-5-5-3". When you are finished editing the process name, press the **ENTER** button on the IC6 to save the changes.

   To change the material number (**"Material #"**), use the **arrow keys** to move the cursor over to the current material number, which is located just to the right of the layer number. Type in the number of the material you want to deposit, as listed in the **"Material"** screen, and then press the **ENTER** button. If it is a commonly used material, you may also find the material number listed on the Material Parameters Sheet in the SOP booklet.

   To change the final thickness (**"Final Thick"**), use the **arrow keys** to move the cursor over to the current final thickness value, and enter the desired thickness for this layer and then press the **ENTER** button. The units for this quantity are kÅ (kilo-angstroms) which means that 50Å would be entered as 0.050 kÅ.

   To change the crucible number (**"Cruc"**), use the **arrow keys** to move the cursor over to that parameter, and enter the desired pocket number where this layer's material is being stored in the hearth. For example, if this layer was intended to be gold (Au) then I would enter a crucible number of "3" since the gold is always stored in this pocket. Press the **ENTER** button to save this value.

Remember that you can add several layers to a process, and if a new additional layer is desired, simply use the **arrow keys** to move the cursor over to the right of the next layer number, and enter in the material number (**"Material #"**) corresponding to this new desired layer, and then press the **ENTER** button. Now you can edit the final thickness and crucible parameters for this new layer just as you did with the previous layer(s) in the process.

If you want to **delete a layer**, use the **arrow keys** to move the cursor over to the material number (**"Material #"**) of the layer you want to delete. Then press the **F1 button** on the IC6 to select the **"Tag Layer"** option which will highlight the layer with a green color (see image below).

0.00Å/s 0.000kÅ 0.00% READY

Overview
Curr Proc
1 - 10

Process Number 22 Layers Defined 2
Name CR

Layer	Material # Name	Final Thick	Thick Limit	Cruc	CoDep	Ratio Cntrl	Cal Stat	Cross Talk
1	2 CR	0.050	0.000	4	No	0.0		
2	1 AL	0.000	0.000	1	No	0.0		
3								

Times to copy 1

CR
Active Process 22
09/18/2018 10:36

One Layer Tagged

Tag Layer | Insert Layer | Delete Layer | UnTag Layer

Now that you have the layer selected, press the **F3 button** on the IC6 to select the **"Delete Layer"** option.

When you are finished editing your process, press the **MENU** button on the IC6 to return to the Main Menu. Once you return to the Main Menu, you can use the **arrow keys** to move the cursor to the **"Operate"** screen option. Once this screen option has been selected, press the **MENU** button to enter this screen. This is the screen you will be monitoring during your run.

Now that you are finished programming your recipes, go back to the bottom of **page 7** and continue reading and following those instructions (waiting for the pumpdown, etc.).