Usage Policies Notebook for CHA Electron Beam One Metal Evaporator

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INRF UCIrvine

Emergency Plan for CHA Electron Beam One Metal Evaporator

Standard Operating Procedures for Emergencies

Contact information

Person	Phone number
Lab Manager	Jake Hes, 949-824-8239 (day), 562-522-8328 (alternate)
Director	G.P. Li: 949-824-4194 (day), 949-824-2047 (alternate)
Staff	Mo Kebaili: 949-824-8239 (day), 949-494-5892 (alternate)
Super User	Carlos Ruiz (818) 527-6349 (Anytime, voicemail or text only)

Hazardous chemicals, gases, and conditions

Hazard name	Description of hazard
Vacuum	Implosion
High temperature	Burn or ignition source
High voltage	Electrical shock, ignition source
Isopropyl alcohol	Flammable solvent
N_2 (nitrogen) gas	Asphyxiant

Alarms or indications of danger

Alarm type	Condition and response
Alarm on the console	Problem with the process state. Halt the process. Correct the problem or notify the staff or the lab manager before continuing.
Pungent or foul smell	Shutdown the machine at once. Contact the staff and the lab manager.

Emergency shutdown plan #1

In the event of an emergency, when there is very little time, turn off the main power of the DC power supply, this will shutdown the high voltage system. Leave the facility at once, and then contact the lab manager or the staff.

Emergency shutdown plan #2

In the event of an emergency, when there are a few minutes available, shut down the DC high voltage power supply and place the tool in the stand-by mode. Leave the facility at once, and then contact the staff and the lab manager.

Usage Policies for CHA Electron Beam One Metal Evaporator

Standard policies for usage

The CHA-600S/CV-8 is a four-pocket e-beam evaporator used for depositing Au, Ti, Ni, Cr, Si, Ge, and Pt, other materials need to be cleared with the staff. The wafers are loaded on a stationary planetary substrate holder. The system will pump down to the base pressure of 2e-6 Torr using a cryo pump. The pumping speed is typically two hours. The metal deposition thickness is measured in real-time by an INFICON model XTC/2 crystal monitor. To verify the deposited metal thicknesses, use the Dektak or the Alphastep surface profilometers.

Contact information

The INRF staff or the lab manager may be reached at 824-8239 or 824-9831.

Authorized users

Only INRF registered users who have completed the training and passed the certification may use this equipment. Users may only use the portion of the system for which they have been trained.

Training

Users must have received direct training from the staff in order to use this equipment. Users are expected to understand the nature of the system, as well as the proper control and use of the crystal monitor. Training varies slightly, depending on the material to be deposited on the substrates. Contact the staff for details and to arrange for a training session.

Usage logs

Users are required to log all activities in the provided log sheets. All users must log when they used the Evaporator (date and time), which materials they deposited, and when they completed their process in the user log sheets. If users notice anything unusual, they should record it on the user log sheets, and add details in the maintenance log sheets. Any maintenance to the tool must be logged in the maintenance log sheets (maintenance staff only).

Safety equipment

There is no specific safety equipment for use on this tool, however, cleanroom gloves and tweezers should be used when handling pieces in the chambers. Care should be taken to avoid hitting their head on the chamber or pinching their fingers upon lowering the chamber.

Standard equipment and materials

The laboratory provides the following gas: N_2. Other gases must be cleared with the lab manager.

User maintenance

Users are requested to clean the chambers after usage, by first vacuuming the base of the chamber then wiping the rim down with the Isopropanol. Dispose of the wipe in a waste container marked for flammable solid waste.

Waste disposal

Dispose of the broken glass and the broken wafers in the appropriate waste container. Dispose of the alcohol soaked wipes in the waste container marked for flammable solid waste.

Scheduling

Reservations can be done on-line, also the system can be used on a first-come, first served usage if no reservation was made.

Other issues

Users should record the base pressure on the log sheets prior to venting the chamber.

Users should remain physically present at the tool during the evaporation run to monitor the deposition rate and the current set point. Users should monitor the chamber pressure during the evaporation run.

On completion of the evaporation run, the system should be left in the idle mode, with the high vacuum valve open. Users should record the roughing time into the log sheets.

Any new materials introduced into the system need to be cleared with the lab manager or the staff.

At no time should a user adjust the tool's pressure regulator.

Non-standard use

Users should not modify any hardware on this equipment. For use of non-standard processes, gases or materials, contact the staff or the lab manager.

Usage Notes for CHA Electron Beam One Metal Evaporator

Guide for using the Metal Evaporator correctly

Electron Beam Metal Evaporator (E-beam one system)

Follow these steps for evaporation of metals on a silicon or glass substrates.

1. **Initial System Check:**

   a. The system is not in use by other lab users.
   b. Check the log-book and verify that the system is working properly from the last user's run.
   c. Verify that the E-beam evaporator power supply is **off.**
   d. Verify that the chill-water valve is turned **off** at the chamber.
   e. Verify that the high vacuum valve is **open** to the chamber.
   f. Verify that the chamber ion gauge pressure reads < 5x10-6 Torr, unless the system was recently used.

2. **Chamber Venting:**

   a. Log on to the tool PC/computer with your user name and password.
   b. Fill out the log sheets, and record the chamber base pressure.
   c. Turn **off** the ion gauge.
   d. Close the high vacuum valve. Once valve is closed wait for fifteen seconds then go to next step.
   e. Open the vent valve to vent chamber to atmosphere. When the chamber is vented, the pressure indicator will read 7.4+2, and to verify the N_2 gas will be escaping from the lower vacuum seal of the bell jar.
   f. Toggle the hoist switch to the up position until the two arrows match on the side of the bell jar. Toggle the hoist switch back to the standby position.

3. **Chamber Inspection:**

   a. Inspect the chamber for peeling, particles, and material splatters. Vacuum and wipe if necessary.
   b. Check for proper operation of the shutter by opening and closing before lowering, and closing the chamber.
   c. Load the metal source crucibles into the gun's turret inside the chamber, do not overfill the crucibles.
   d. Check the log sheets or the thickness monitor if a new crystal is needed, ask the staff to change it now.

e. Check to make sure that the crucible is visible through the mirrors. Replace the mirrors (bare silicon wafers) if needed.

4. **Substrate Loading:**

a. Open the shutter.
b. Record the turret pocket locations in which the crucible metal sources are loaded.
c. Load the substrates onto the substrate holder. Use Kapton (polyimide) tape to secure the substrates.
d. Wipe the full circumference of the base plate and the bell jar seal using clean wipes and ensure that the o-ring is properly seated up against the bell jar.
e. Lower the bell jar, by toggling the hoist switch to the down position until the bell jar rests onto the base plate, and then toggle the hoist switch back to the standby position (center).

5. **Pump down chamber:**

a. Open roughing valve by turning on roughing switch on auto-tech II controller.
b. Monitor roughing pumping speed to ensure that the chamber was positioned correctly and record the roughing time in the log sheet.
c. Wait until the chamber pressure drops below <70 mTorr (7.0 e-2).
d. Close roughing valve by switching off the switch on the auto-tech II controller.
e. Open Hi vacuum valve by switching on the switch on the auto-tech II controller.
f. When the convectron gauge reaches the maximum scale, turn on the ion gauge.
g. Wait about two hours for the chamber to pump down to below < 5e-6.

6. **Program Thickness monitor:**

a. From the monitor display, push the **REST** button.
b. Ready indicator should be displayed on the monitor.
c. Push the **PROG** button (go to the parameter display).
d. Change the film# first.
e. Use up and down arrow to move the cursor.
f. Move the cursor to film #, use the material/film # chart and input the film #.
g. Push enter 'E'.
h. Input the next setting the same as the film #.
i. Push enter 'E'.
j. Move the cursor to density and z-ratio and verify the setting with the material/film # chart, change the setting if necessary.
k. Push **PROG** to return to monitor display.
l. Push **START** to update the film #.
m. Push **STOP** for stand-by.

7. **Deposition:**

a. Turn **on** the chill water and verify proper water flow.
b. Record the chamber pressure it should be <5e-6 Torr.
c. Turn **on** the main power at the e-gun power supply.
d. Check the following illuminated lights on the CV-8 controller:
    - Power on (on)
    - Air (on)
    - Door (on)
    - Vac Tank (on)
    - Vac Gauge (on)
e. Turn the key on the CV-8 controller to the **ON** position.
f. Push the "HV On" button in; hold in the button until the relay clicks on and the meter indicates the voltage (7.5KV).
g. Check to make sure that the current adjustment knob is set to zero (rotated all the way to the **counter clock wise** position).
h. Push the "Gun 1 Fil On" button.
    - **Warning: Always wear proper eye protection when viewing the beam.**
i. Make small adjustments on the current adjustment knob to warm up the source material.
j. Once the source material is ready for deposition, on the thickness monitor control panel, push the **start** button, push the **zero** button, and **open** the shutter.
k. Continue to monitor the source during deposition. Make small adjustments to the beam if necessary.
l. When the desired thickness is reached, slowly adjust the current adjustment knob back to zero (counter clock wise).
m. Push the "**Gun1 Fil Off**" button.
n. If additional layer is needed, repeat Program Thickness Monitor steps.
o. Repeat steps g to m for additional metal layer.
p. Push the "**HV Off**" button
q. Turn the key on the CV-8 controller to the **off** position.
r. Turn the main power **off** at the e-gun power supply.
s. Wait 10 minutes for the system to cool down.
t. Turn **off** the chill water.

8. Venting and Unloading:

a. Turn **off** the ion gauge.
b. Turn **off** the Hi-Vac switch.
c. Wait until the switch closes.
d. Turn **on** the vent switch.
e. Wait until the "7.4 +2" is indicated on the meter (about 2 minutes).
f. Verify that the N_2 is escaping from the main chamber seal under the bell jar.

g. Toggle the hoist switch to the **up** position until the two arrows match on the side of the bell jar. Toggle the hoist switch to the **standby** position. Remove the substrate holder from the chamber.

h. Open the shutter and remove your source metal (s).

i. Close the shutter.

9 **Chamber Pump down:**

a. Wipe the full circumference of both sides of the jar seal using clean wipes and ensure that the o-ring is properly seated.

b. Lower the bell jar by toggling the hoist switch to the **down** position until the bell jar rests on the base plate, and then toggle the hoist switch back to the **standby** position (center).

c. Turn **on** the Roughing switch.

d. Monitor the pump down to be sure that the chamber was positioned correctly.

e. Wait until the chamber pressure drops below 70 mTorr (7.0 e-2).

f. Turn **off** the Roughing switch.

g. Turn **on** the Hi-vac switch.

h. When the thermo gauge reaches the maximum scale, turn on the ion gauge.

i. Check the meter and verify that the chamber is under hi-vac.

j. Log out of the log-in computer.

k. Clean up the area.