CORAL Title: EBeam-Temescal-FC2800

Location: Bay 4L
Purpose: Physical Vapor Deposition
Contact: Dave Terry

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Introduction

The EBeam-Temescal-FC2800 is a physical vapor deposition (PVD) tool that uses a high-energy electron beam to evaporate and deposit thin films (typically less than 1 um) from a broad selection of metal targets. The system operates under high vacuum which provides a long mean-free-path for the evaporated material to deposit on substrates in the form of a thin film. When used in conjunction with a photoresist that has a re-entrant profile (negative sidewall slope), this line-of-sight deposition allows for patterning of metal via the liftoff process.
This eBeam system can accommodate samples ranging from small pieces to 200 mm wafers. The material crucibles (source) for this tool are held under vacuum while the substrates are held in a vented loadlock to reduce the pumpdown time and overall process duration. The system uses quartz crystal monitors (QCM) to measure the amount of material deposited in real time. This information determines the rate of evaporation and provide feedback to control the electron beam power to the source target material which, in turn, regulates deposition to the desired final thickness input by the user.



Safety

- The EBeam-Temescal-2800 uses high voltage and high current to generate the electron beam. Under normal operating conditions with the

system panels in place, the user is protected from these hazards. Do not remove any system panels or attempt to defeat any system interlocks.

- The system's chamber door is heavy and could be a potential pinch-point. Avoid placing fingers or foreign objects between the door and the chamber edge while it is closing. Personal injury or damage to the machine could result.
- The system has an emergency power off button (EMO). If the system is behaving dangerously, the EMO may be pressed. Always notify staff if the EMO is pressed.

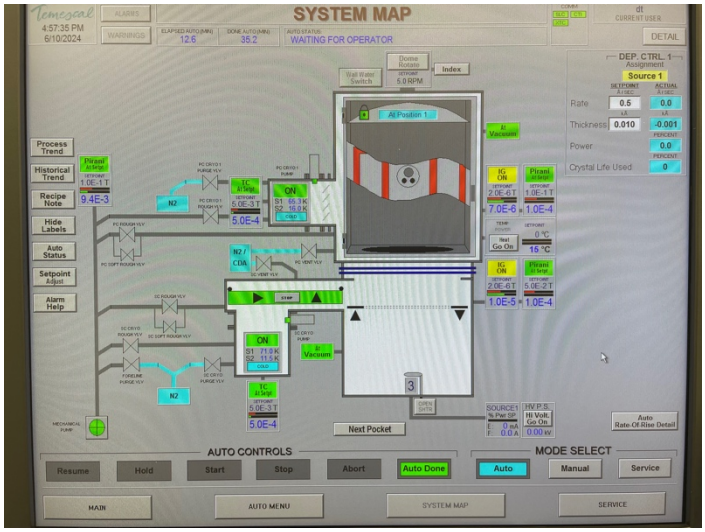
User Qualifications and Responsibilities

- User must have a PTC approved process to use this tool.
- This equipment must be used in accordance with the instructions and information contained in this SOP. Be sure to follow the step-by-step instructions bellow.
- Users must check the metal levels in the crucible as the power is ramping up and the beam becomes visible. If the material level is low, abort the run and notify staff.
- When working with Standard Recipes, users may only modify the final thickness parameter. Discuss with staff if a custom recipe is needed with different parameters.
  - **Under no circumstances should the Dome Rotation Speed, Datalog Config, Deposition Rate, or Base Pressure parameters be altered.**
- Users must remain at the tool during the deposition to monitor progress.
- After a process is complete and samples have been removed, the system must be left in a pumped-down state.
- **If system alarms occur during a run: Acknowledge the alarm and click on the "Resume" button quickly. If the same error occurs a second time, do not proceed. Report the issue(s) in CORAL, and then notify staff.**
- Report any other system abnormalities; broken, missing, worn parts; or general contamination to the lab staff immediately, via CORAL.

Operating Procedures

There are six permanent metals loaded into the system: Aluminum, Titanium, Nickel, Iron, Silicon Dioxide (SiO2), and Gold. These crucibles DO NOT get swapped out. If you require any other metals, go to the "Loading a Crucible" section in the Appendix.

Load the Chamber



1. Engage the tool in CORAL.
2. Wake up the monitor.
3. Be certain you're logged in as user, and you're on the Auto Menu screen.
4. Click on the Vent PC button.
5. Click on the Start button.
6. Click on the System Map Button.
7. Wait for the DOOR OPEN light to turn on, AND the Auto Done button to turn green.
8. Press the DOOR OPEN button.
9. Wait for the latch to release.
10. Open the door to its fully open position.
11. Load your samples or wafers as necessary.
12. Fill any empty slots with wafers or blank plates.
13. Close the chamber door.
14. Wait for the latch mechanism to engage.
15. Click on the Auto Menu button.

16. Click on the Pump PC button.
17. Be certain the Down/Open button is selected.
18. Click on the Start button.
19. Click on the System Map button.
20. Wait for the Top ION gauge to read 2.0E-06, ~15 min.

Tooling Configuration Files

1. Refer to the Tooling Configuration Chart (Appendix A) and determine which Config file is suitable for your deposition.
2. On the Auto Menu page, click on Tooling.
3. Click on Select File.
4. Click on the file that best matches your deposition needs.

If there isn't a Config file that meets your needs, contact Dave Terry for assistance.

5. Click on the Open button.
6. Click on the close button.
7. This completes the Tooling Config section.

Edit a Recipe

1. Click on the Auto Menu button.
2. Under EDIT, click on the Recipe button.
3. Click on the Select File button.
4. Click the recipe you wish to use for processing. If the file you require doesn't exist, contact staff for assistance.
5. Click on the Open button.
6. Click on the first deposition step.
7. Click on the Edit Step button.
8. Click on the Next Page button until you are on Page Four.
9. Click on the S1 Final Thickness data box.

DO NOT CHANGE ANY OTHER PARAMETER!

10. Click on the First Page button.
11. Click on the Save Step button.
12. Repeat this section for any subsequent Deposition Steps.
13. Click the Close button.

Run a Recipe Section

1. Click on the Select button.
2. Click on the previously edited recipe file.
3. Click on the Open button.
4. Click on the Recipe button.
5. Click on the Start button.
6. Click on the Show Data Log Configuration button.
7. Enter your name, CORAL ID, run data, or process description.
8. Click on the OK button.
9. Click on the Accept button.
10. Click on the Start button.
11. Click on the Start Recipe button.
12. Click on the System Map button.

13. Wait for the SOAK 2 step.
14. Open the Viewport Shutter.
15. Observe the scanning beam.
16. Be certain that the beam is centered on the material.
17. If the beam alignment is correct, close the Viewport Shutter.
18. If the beam appears to be off center, contact Dave at once.
19. Wait for the process to complete.
20. Auto Process Completed!
21. Click on the OK button.
22. Press the OPEN DOOR button and open the chamber door to its fully open position.
23. Unload your samples or wafers as needed.
24. Close the vacuum chamber door.
25. Be certain the door latch engages.
26. Click on the Auto Menu button.
27. Click on the Pump PC button.
28. Be certain that the Down/Open button is selected.
29. Click on the Start button.
30. Wait for the Auto Done button to turn green, 5-7 min
31. If necessary, go to the Unloading a Crucible section in the Appendix.
32. Disengage from CORAL and enter your process data.

Appendix:

Loading a Crucible

1. Click on the Vent SC button.
2. Click on the Start button.
3. Click on the System Map Button.
4. Wait for the Auto Done button to turn green.
5. Open the lower compartment door.
6. Using both hands, press both BLACK buttons to lower the tray to the bottom position.
7. With both hands swing the tray out to its fully open position.
8. If flakes of metal, peeling metal, or other debris, are seen on the tray, use the vacuum cleaner to remove them.
9. Remove the shutter.
10. Only if the pocket number indicated in the numeric box above the Next Pocket button is incorrect, follow these instructions:
    - Click on the numeric box.
    - In the pop up window click on the Turret Pocket Number Requested.
    - In the Turret 1 Position Request Box, enter the desired pocket number.
    - Click on the OK button.
    - Click the Go On button.
    - Wait for the turret to move to the requested pocket.
    - Remove the crucible, and place it into its proper container.

CAUTION: The crucible could be **VERY HOT!** Have a pair of tweezers ready to help remove it.

11. Check the materials weight chart, and verify the weight of the new crucible before loading. If it is below the minimum weight, do not continue, and call Dave Terry for assistance.

Be certain that you place the crucible into the correct pocket. Refer to the Material Reference Chart.

12. Each pocket is numbered, as in this example of pocket 1 for Aluminum:
13. Repeat these steps for any additional materials.
14. Click on the Close button.

15. Replace the shutter.
16. Using both hands move the tray back to its home position.
17. Using both hands use the raise (Red) buttons to move the tray up to it's a load position.
18. Close the lower compartment door.
19. Click on the Auto Menu button.
20. Click on the Pump SC button.
21. Be certain that the Down/Open button is selected.
22. Click on the Start button.
23. Click on the System Map button.
24. Wait for the bottom ION gauge to reach 2.0 x 10-6.
25. Click on the Auto Menu button.
26. End of Loading a Crucible section, return to the Load the Chamber section.

Unloading a Crucible

1. Click on the Vent SC button.
2. Click on the Start button.
3. Click on the System Map Button.
4. Wait for the Auto Done button to turn green.
5. Open the lower compartment door.
6. Using both hands, press both BLACK buttons to lower the tray to the bottom position.
7. With both hands swing the tray out to its fully open position.
8. If flakes of metal, peeling metal, or other debris, are seen on the tray, use the vacuum cleaner to remove them.
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14. Using both hands move the tray back to its home position.
15. Using both hands use the raise (Red) buttons to move the tray up to it's a load position.
16. Close the lower compartment door.
17. Click on the Auto Menu button.
18. Click on the Pump SC button.
19. Be certain that the Down/Open button is selected.
20. Click on the Start button.
21. Wait for the Auto Done button to turn green.

Configuration Files

Configuration	Pocket: Material
Config 1	6: Gold 7: Chromium 8: Silicon Dioxide
Config 2	6: Molybdenum 7: Chromium 8: Silicon Dioxide
Config 3	6: Gold 7: Chromium 8: Tantalum
Config 4	6: Gold 7: Chromium 8: Tungsten