

Date: Sept. 2020

AXIC PECVD

1. Purpose

The BenchMark AXIC PECVD is a Plasma Enhanced Chemical Vapor Deposition system used to deposit Silicon oxide and nitride. The system consists of a process chamber, main unit, RF generator, heater, and automatic pressure controller. There are six gas lines:

| O ₂ | CF ₄ | N ₂ O | NH ₃ | 10% SiH ₄ | N ₂ |
|----------------|-----------------|------------------|-----------------|----------------------|----------------|
| 200sccm | 200sccm | 200sccm | 100sccm | 200sccm | 200sccm |

Maximum RF power: 600 Watts

Maximum electrode temperature: 400 C

Minimum base pressure: 20 mTorr



Figure 1 - Axic PECVD System

2. Loading a Sample

Windows Login: BenchMark70134 (No password)

Benchmark Login: student (No password)

1. Change the HiVac process valve to off. Wait until you hear the vacuum valve close.
2. Change the Vent process valve to on. Wait for the process chamber to reach atmosphere. The Vac/Atm status will turn green and change to Chamber at ATMOSPHERE.
3. Open the chamber using the Hoist button.
4. Place the Axic Safety Bar underneath the back of the open chamber as a safety measure.
5. Verify that there are no particles or contaminants present inside the chamber, then place your sample on the electrode.
6. When the sample is placed, remove the safety bar.

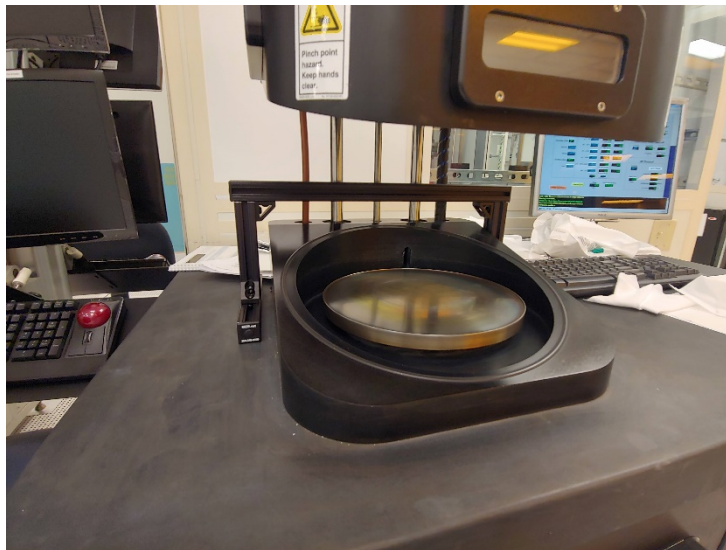


Figure 2 - Axic Chamber Open with Safety Bar In Place

3. Processing a Sample

1. Close the process chamber by changing the **Hoist** to down
2. Open the **SoftVac** valve to start pumping.
3. Wait for the process chamber pressure to reach 1500 mTorr or lower.
4. Close the **SoftVac** valve.
5. Change the **HiVac** valve to open.
6. Set the temperature for the electrode heat controller and change the **Control** to on.
7. Wait until the temperature reaches the set point.
8. Input the **MFC Valves** set points for the process gases needed.
9. Change the corresponding **MFC Valves** from closed to open.
10. Change the **Freeze/Follow All** to Follow All. The gases will start flowing.
11. Set the process pressure in the **TV Setpoint** value. Change **TV Go to Setpoint** to on.
12. Check the electrode spacing and change it if needed.
13. Set the RF generator power by entering your RF power in **Setpoint** value.
14. Set the **Manual Run Timer** to the desired deposition time.
15. Once the pressure, gas flows, and temperature are within desired ranges and stabilized, click on **Manual Run** to start the process. When the timer reaches zero

- the RF, heater, pressure controller, and gases will be turned off.
16. After deposition, purge the process chamber using 200 sccm N₂. Enter 200 into the N₂ **MFC Setpoint**. Change the N₂ **MFC Valve** from closed to open then click the **follow all** button.
 17. Turn off N₂ purge after the chamber has been purged at least 5 minutes.
 18. Wait for the system to reach base pressure.
 19. Change the **HiVac** process valve to off. Wait until you hear the vacuum valve close.
 20. Change the **Vent** process valve to on. Wait for the process chamber to reach atmosphere. The **Vac/Atm** status will turn green and change to Chamber at ATMOSPHERE.
 21. Open the chamber using the **Hoist** button.
 22. Place the safety bar inside the back of the chamber.
 23. Unload your sample. **THE ELECTRODE IS HOT, SO BE CAREFUL.**
 24. Wipe the process chamber down thoroughly using clean room wipes and IPA/DI.
 25. Remove the safety bar.
 26. Close the process chamber changing the **Hoist** to down.
 27. Run CF₄/O₂ clean process to clean the chamber. Please make sure the chamber is clean.
 28. Fill out the equipment log kiosk page.

- Please contact **Rich Hosler** (hosler0@purdue.edu) if you have any questions.

4. Recipes:

Silicon Dioxide:

| | |
|--------------------------|-----------|
| Pressure | 230 mTorr |
| RF Power | 26 Watts |
| 10% SiH4 | 35 sccm |
| N2O | 200 sccm |
| Temperature | 300C |
| Electrode spacing | 2.5" |

CF4/O2 Cleaning:

| | |
|--------------------|-----------|
| Pressure | 600 mTorr |
| RF Power | 200 Watts |
| CF4 | 20 sccm |
| O2 | 100 sccm |
| Temperature | 250 C |

Silicon Nitride: Chamber Conditioning prior to deposition

| | |
|--------------------------|-----------|
| Pressure | 600 mTorr |
| RF Power | 150 Watts |
| NH3 | 100 sccm |
| Temperature | 300C |
| Electrode spacing | 3" |
| Time | 5 min |

SiNx Recipes*

| NH3/SiH4 | Pressure | Temp | RF | Dep Rate |
|-----------------|-----------------|-------------|-----------|-----------------|
| 100/120 | 400 | 300 | 100 | ~18 nm/min |
| 100/120 | 600 | 300 | 100 | ~39 nm/min |
| 100/120 | 600 | 300 | 150 | ~40 nm/min |
| 100/120 | 600 | 150 | 150 | ~46 nm/min |

**Pre-condition chamber using above recipe for best results*

SiO2 Recipes

| N2O/SiH4 | Pressure | Temp | RF | Dep Rate |
|-----------------|-----------------|-------------|-----------|-----------------|
| 200/35 | 230 | 200 | 100 | ~40 nm/min |
| 200/35 | 230 | 170 | 50 | ~40 nm/min |
| 200/35 | 230 | 140 | 50 | ~40 nm/min |
| 200/50 | 230 | 250 | 50 | ~55 nm/min |
| 200/50 | 230 | 250 | 26 | ~55 nm/min |
| 200/35 | 230 | 250 | 26 | ~40 nm/min |
| 200/100 | 230 | 250 | 50 | ~90 nm/min |
| 200/100 | 230 | 250 | 26 | ~60 nm/min |