NanoFabrication Facility
ADVANCED SCIENCE RESEARCH CENTER

Standard Operating Procedure: PECVD

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Standard Operating Procedure: **PECVD**

Hardware Description and Principle of Operation

Oxford PlasmaPro System 100 PECVD

The Oxford Plasma Enhanced Chemical Vapor Deposition (PECVD) is utilized for depositing silicon dioxide, silicon nitride, amorphous silicon, and other films.

Material Requirements

Equipment: substrate, conditioning/cleaning substrate and tweezers

Personal Protective Equipment: nitrile gloves

Procedure

Estimated Time: ~50 minutes plus 2x Deposition Time

i.e. Depositing 500 nm Fast SiO2 (~3 minutes): ~56 minutes total processing time

Condition Chamber

1. Set match position to appropriate setting for desired film to be deposited.
2. With clean/conditioning wafer already in the tool, run a conditioning recipe under RECIPES (Process → Recipes).
3. Select **LOAD** and select **YES** when system asks to overwrite current recipe. Load desired recipe to run and select **OK.**
4. Edit recipe run time by selecting the deposition step (usually the recipe name; usually the 4th step), click **EDIT STEP** and change the step time so that you achieve ~200 nm of the film being deposited. Select **OK** and click **RUN**. When asked to run a second process on the current wafer, select **OK**.
    a. Note: There are special conditioning recipes for Amorphous Silicon and Silicon Carbide. To use either of these, load the condition recipe and then click **RUN**. No process parameters need to be changed for these recipes.
5. When conditioning is complete, select **ACCEPT** when the “Yellow Alert” window flashes.
6. Wait for the wafer to return to load lock.

Load Sample

1. Under PUMP CONTROL (System → Pumping), vent the load lock by selecting **STOP** then **OK** then **VENT** in the “Evacuating LoadLock” panel.

2. When vent is complete, open the load lock, unload cleaning/conditioning substrate and load sample with the flat side of the substrate flushed against the two screws on the sample transfer arm.
3. Close lid and evacuate the load lock by selecting **STOP** then **EVACUATE** in the “Evacuating LoadLock” panel. Enter wafer name and select **OK**.

Run Recipe

1. Under RECIPES (Process → Recipes), select **LOAD** and select **YES** when system asks to overwrite current recipe. Load desired recipe to run and select **OK**.
2. Edit recipe run time by selecting the deposition step, click **EDIT STEP** and change the step time to the desired value and select **OK**.
3. Select **RUN** to start the recipe.

Unload Sample

1. When process is complete, select **ACCEPT** when “Yellow Alert” window flashes.
2. Wait for wafer to return to load lock.
3. Under PUMP CONTROL (System → Pumping), vent the load lock by selecting **STOP** then **VENT** in the “Evacuating LoadLock” panel.
4. When vent is complete, open the load lock, unload the sample and load cleaning/conditioning wafer with the flat side of the substrate flushed against the two screws on the sample transfer arm.
5. Close lid and evacuate the load lock by selecting **STOP** then **EVACUATE** in the “Evacuating LoadLock” panel. Enter **clean** for wafer name and select **OK**.

Clean Chamber

1. Set match position to appropriate setting for cleaning.
2. Run a cleaning recipe under RECIPES (Process → Recipes). Select **LOAD** and select appropriate cleaning recipe.
    a. *Timed Clean*
        i. Select **OPT CLEAN HF/LF timed new**. Edit recipe run time by selecting the **High pressure clean** step, click **EDIT STEP** and change the step time so that it matches >75% of your deposition time (i.e. deposited for 60 seconds, clean should be for 45 seconds). Click **OK**.
    b. *End Point Detection Clean (if deposition was >15 minutes)*
        i. Select **OPT CLEAN HF/LF EPD new**. Click **OK**.
3. Select **RUN**.

PEVCVD Process Parameters

Recipe	Match Position	Rate (nm/min)	Index
Fast Nitride	430	99.51	2.16
Slow Nitride	175	10.69	1.98
SLow Nitride NH_3 Free	882	9.93	1.96
Fast Silicon Dioxide	175	170.2	1.46
Slow Silicon Dioxide	175	52.54	1.46
Clean	430	N/A	N/A

Emergency Stop

- To abort a recipe mid-deposition, use the jump button to skip the rest of the deposition step and go to the post-deposition pumps and purges. Do not use the stop button.
- In the case of an emergency where a tool malfunction puts users in imminent danger, press the red EMO button on the tool. This is only to be used as a last resort.

Allowed Activities

- Film thickness can be characterized with the Filmetrics tool.
- Users can create their own recipes. They must be careful not to overwrite the ASRC recipes.

Disallowed Activities

- Do not use resists, polymers or tape in the PECVD.
- Do not change the match position while a recipe is running. Pause the process and then change the match position before resuming the process.
- Do not change any of the process parameters other than the deposition time in the ASRC recipes.

- Do not deposit too much of a material before running a clean. For SiO2 > 10µm, SiN > 5 µm, a-Si > 4µm, or SiC > 1.5µm, depositions must be split in half and the chamber must be cleaned at the halfway point.

What to watch out for during operation

- If the carrier wafer used for the chamber clean is becoming over etched, it must be replaced otherwise it will inevitably break inside the chamber.
- Be sure to change the match position to 430 when running the clean, otherwise the reflected power will be too high and the recipe will abort.

Common Troubleshooting Tips

- Check that the match position is at the correct setting for your recipe.

When to call staff?

- If the pump fails.
- If a wafer breaks or gets stuck in the chamber.

Badger Criteria

Report Problem:

- Gas flow is low.

Shutdown:

- When pump is failing.
- Wafer stuck or broken in the chamber.

Revision History: