Level 1 Protocol

Operating instruction Manual for the Tystar Oxidation/Diffusion Furnace Systems

Restrictions:

- Tool C (Bank 1) is for clean silicon processes only. (CMOS, electronic devices, or other related non-metal processes. ASK IF YOU ARE NOT SURE WHAT YOU CAN OR CANNOT DO!
    - Use only plastic tweezers
    - No metals

- Tool B (Bank 2) is for general thin film applications.
    - MEMS or other non-electrical applications
    - Oxidation
    - Sintering
    - Annealing

- Level 1 Protocol
    - Start-up level instruction
    - Recipe control only
    - No manual operation allowed
    - No editing of existing programs or recipes

These instructions are written for the Tystar systems operating under normal conditions. If the system is not in normal operating mode, you must contact the Nanofab Staff.

Tool Overview:

Each furnace bank consists of four process tubes. From the top of the furnace bank down, the tubes are defined as follows:

Top Tube: Wet Oxidation – Tube 1 (T1)
Second from top: Dry Oxidation – Tube 2 (T2)
Third from top: Boron Solid Source Doping – Tube 3 (T3)
Bottom Tube: Phosphorous Solid Source Doping – Tube 4 (T4)

Each bank is defined as follows:

Tool A: Bank 3 (LPCVD)*
Tool B: Bank 2 (Atm-General Use)
Tool C: Bank 1 (Atm-CMOS Only)

*Tool A (Bank 3 – LPCVD) instructions are not part of this document!

Furnace bank details:

- Each furnace bank consists of four process tubes defined above.
- Each tube has a dedicated FCS-10 controller.
- The FCS-10 controller allows input control over the furnace tube.
- From the FCS-10 controller you can enter times and temperatures in an existing recipe.
- Users will not be allowed to write recipes in the level 1 protocol.

Operation:

Start up:

1. All system components should be on and running 24 hours, 7 days a week. If the system is not on or is not operating in a normal condition, contact the Nanofab Staff and do not attempt to start the system without assistance.
2. The FCS-10 CRT will either display the system status or will be set to the main menu. (Add Picture)
3. From the main menu, you can load recipes, display status, display recipe, and load a recipe.

Loading a recipe:

1. If the display is not set to the main menu, press MENU on the controller keypad.
2. To load a recipe, enter RL on the FCS-10 and press enter.
3. Choose the proper recipe by moving the cursor with the right arrow key.
4. After you highlighted the desired recipe, slowly, press ENTER twice.
5. You will be prompted to enter the temperature for each zone.
6. You must enter the temperature from the numeric keypad and press ENTER after each entry. DO NOT USE THE LEFT ARROW KEY IT MAY CRASH THE CONTROLLER DUE TO AN INHERENT GLITCH-Use CLEAR instead!
7. After entering the temps for the three zones, you will be prompted to enter the required time. This is entered as hr:mn:sc.
8. You should get a response that the recipe load has been completed.
9. Press MENU to get back to the main screen.

Running a recipe:

1. To see the recipe screen, press DS (display status). This screen shows the current recipe, and the system status should be in IDLE.
2. Press RUN on the controller to start the recipe. The system will be in run mode.
3. The boat loader should begin to come out for wafer load. This can take about 15 minutes.

Warning! Do not leave items on the load station table! The auto loading cantilever of the bottom tube can crush or collide with items left on the table.

4. After the boat reaches the outer limit switch, it will sound an alarm to notify the user that the boat loader is now ready to be loaded with wafers. The boat loader will not stay out more than the set time. If you need to keep the boat loader out for a period of time longer than the set time, press the HOLD button.

Wafer loading:

1. Two methods can be used to load wafers.

Method 1: (recommended)

- Leave the quartz cassettes on the cantilever and remove dummy wafers and place your wafers in the open slots. (It can get warm!)
- This may require the use of the portable step-stand.

Method 2:

- Remove the quartz cassette from the cantilever using the pickup tool. USE CAUTION-WEAR HEAT PROTECTIVE GLOVES!!!!
- Carefully lower the cassette to the table at the load station.
- Remove dummy wafer(s) and place your device wafer(s) in the empty slot.
- Make sure the wafer is properly aligned (there is a slight angle to the boat tilting the wafers slightly).
- Put the boat back on the cantilever. Make sure the boat is seated level and the bottom of the boat is centered on the quartz rails about center of the loader is you are using one boat.

Continue Running Recipe:

1. If you are in HOLD mode, press RUN. The boat loader will go in after the set time has been elapsed. To activate boat loader manually, press EVENT, this will skip the “load wafer-LDWF” step and go to the “boat in-BTIN” step.
2. If all conditions are good, the recipe will continue. If there is an error, the system will alarm and display a SHLD (special hold). This will stall the process and you will need to notify a Nanofab Staff member.

Unloading Wafers:

1. After the process has been completed, the alarm will sound and the FCS-10 will display a HLD1 condition. This is an operator wait mode. The wafers will stay in the furnace under N2 ambient conditions until the operator presses EVENT to skip to the unload wafer step.

2. The wafer boat will slowly come out, and will stop after it reaches the outer limit switch. DO NOT REMOVE WAFERS WHEN THE BOAT LOADER IS MOVING!!!!
3. When the boat loader reaches the outer limit, it will stop for a set period of time (15-20 minutes). After the set time has elapsed the boat loader will return to the furnace. Press HOLD while unloading wafers if you need more time than the set time.
4. Once your wafers have been removed, replace dummies (if applicable). If in HOLD mode, press RUN. The boat loader will go in by itself, if it is not in HOLD mode, you can also press EVENT to skip the Unload wafer step and go to boat in. After the boat returns to the in position, the recipe is complete.