

Spin on Dopant SOP

Materials

Dopant: Filmtronics B155

Wafer: n-type 3-9 ohm cm

Wafer process list:

- All integration wafers
- 1 B155 control, blank n type with SOD.
- 1 oxidation control, blank n type, NO SOD.

Spin on procedure:

SET UP:

1. Spin Coater
 - a. Ensure that both the pump and coater are plugged in and switches are turned on. The spin coater and pump can be found on the wood shelf to the right of the fume hood.
 - b. Turn lever valve that connects Nitrogen to coater OFF. Ensure the Nitrogen tank is above 50 psi
 - c. Turn ON Nitrogen adjust the regulator to psi to 35 (don't want too much pressure)
 - d. Turn the lever valve to ON position
 - e. Turn ON coater, then adjust psi until it turns on (normally ~40 psi)
 - f. Click the spin time setting to view the parameters
 - g. Settings:
 - i. Acceleration time: 12 sec
 - ii. Speed time: 50 sec
 - iii. Spin speed: 2000 RPM
 - iv. Decel Time: 0.5s
2. Hot plate
 - a. 200°C
3. Native OX removal
 - a. Methanol bath
 - b. Follow BOE SOP

PROCEDURE:

1. Add wafers to boat and submerge in BOE for 30 seconds. Make note of the order wafers are placed in the boat. Shiny side should face away from the handle

2. Quench in DI water for 30 seconds. Rinse in DI water for 30 seconds. Add to methanol bath to prevent oxidation
3. Retrieve the B155 dopant from the hazardous materials cabinet under the fume hood. It is in an amber dropper bottle, ensure the label says B155.
4. Place clean n-type wafer from the methanol bath on chuck, do not dry methanol
5. Use black alignment tool to center wafer. This tool is found in the tan container in the shelves next to the spin coater shelf.
6. Do a practice run, wafer should have minimal “wobble”. This will dry the methanol. Allow practice run to go for more than 30 seconds. Less time could fail to fully dry the methanol.
7. Fill the B155 dropper as much as possible, squeezing all air from the rubber bulb then inserting it into the amber vial and releasing the bulb. Keeping the dropper vertically move over the center of the wafer and dispense the entire dropper. Return the dropper to the vial and IMMEDIATELY close door and start spinning.
 - a. If the dopant sits on wafer for a long time without spinning it will create a line after the soft bake
8. After spin is complete, transfer wafer to hot plate. Keep level.
 - a. ~200° for 12min (10-15min is recommended)
9. Turn off nitrogen gas. Turn off spin coater. Close lever valve to spin coater. Turn off pump and spin coater on the power strip. Return spin coater to the shelf.

DRIVE-IN PROCEDURE:


Tube furnace: Ramp up and down same as Oxidation settings, just have to change the soak temperature and the running time from preceding/following temperatures. The AlleyCat flow for nitrogen meter should be set to 100 sccm. Click the setpoint button to adjust.


N_2 100 sccm entire run. Soak at 1150°C for 55 min.

1. Plug into 220 VAC.
2. Turn the “Main Power” switch to the **ON** position.
3. Enter the desired heating curve. An example of a heating curve is shown on the next page.













a. Press 

b. **C01** will be displayed on the red PV screen.

i. Use the  buttons and set the starting temperature to 0.*

ii. Press return, , to set the time, **t01.****

1. Use the  to adjust the time.

2. To change to a higher value, press the  until the correct place value is selected.
 3. The dot is NOT a decimal, it's the place value selected.
 4. Use the   buttons to enter the desired values.
- iii. Press return, , to change **C02**.
1. Use the   to adjust the time.
- iv. Press return, , to set **t02**.
1. Use the    to enter the desired time.
- v. Repeat all steps to enter the rest of the heating curve.
- vi. The last step is the kill code, -121 on **t0x**.
- c. To start the program, hold  until "run" appears on the LCD. Press the
- green button, .

*The starting temperature is always 0.

**THE MAXIMUM TEMPERATURE INCREASE RATE IS 10 °C/MIN.

Heating Curve

Drive In			
Temp (initial) deg	Change	Time (minutes)	Gas
0	10degC/min	20	N2 @60sccm O2 @20sccm
200	0degC/min	20	N2 @60sccm O2 @20sccm
200	10degC/min	40	N2 @60sccm O2 @20sccm
600	0degC/min	20	N2 @60sccm O2 @20sccm
600	10degC/min	55	N2 @60sccm O2 @20sccm
1150	0degC/min	55	N2 @60sccm O2 @20sccm
1150	-5deg/min	60	N2 @60sccm O2 @20sccm
850	0	20	
850		120	
200	Turn off		Turn Off
	Time Total (hour:	6.833333333	

1. Load the wafer(s) into the center of the quartz wafer boat and insert them into the tube furnace with the polished side toward the gas flow. Center the wafer boat as much as possible.
2. Insert the 2 thermal blocks (blocks should be aligned with inside not outside) and close the door. Secure the door by hand tightening the screws.
3. Turn the tube furnace on per the **Tube Furnace Operation** and enter the heating curve.
4. Turn on the N₂ gas. Make sure its on outside.
 - a. On the left, rotate the valve labeled “Nitrogen” counterclockwise 3 full turns.
 - b. On the right, turn the valve also labeled “Nitrogen” to the ON position.
 - c. Set the flow rate on the ALICAT N2 to 100 SCCM (standard cubic centimeters per minute). Check gas flow is still constant 10 min after starting.
 - d. Allow the N₂ gas to flow during the pre-heat process.
5. Allow the tube furnace to cool down to at least 400 °C before turning it completely off. The furnace will automatically turn of at 200 °C but can be shut off before. If the furnace hits 200 °C it should still be turned off via the black knob and the gasses should be closed, both butterfly and needle valves and in the chase.
6. Remove the wafers and put them each in a wafer carrier labeled with the date and position in the wafer boat.

SOD Removal

1. Using phone camera, take a picture of control wafer and an integration wafer. Save to drive.
2. Image several features on optical microscope.

3. Break control wafer in half.
4. Etch half of the control wafer until it sheets in center, record time the edge sheets and the center sheets. Use SOD BOE.
5. Image other half in the SEM, record thickness of center and edge, back out etch rate based on thickness and time to sheet.
6. Use 4 point probe on etched half of control wafer. 1mA, .001 cm thickness. If resistivity is 1×10^{-3} or smaller, doping worked.
7. Break an integration wafer
8. Image half and record SOD thickness in the active opening
9. Use the etch rate for the control wafer to find how long to etch the int wafer. Add 15% to the time
10. Etch all integration wafers and the unimaged half of the broken integration wafer for the calculated time. Use SOD BOE.
11. Image the half integration wafer and ensure all SOD is removed from the active area.
12. Take some optical microscope pics.