

STANDARD OPERATING PROCEDURE
FOR TUBE "A4-Polyamide" furnace in TRL.

INTRODUCTION

Tube "A4-Polyamide" is an Atmospheric furnace designed for Polyamide curing up to 450C. Other organic materials can be processed with PTC approval, on wafers up to 6 inch in diameter.

The system is operated in manual mode. Three Eurotherm temperature controllers provide a 20 inch long, flat profile in the Center Zone; they are arranged in a master/slave configuration and the temperature profile is set up in manual mode. The gases are introduced through a quartz injector, located at the Source end of the tube.

The gas control is provided by the Argus 581 Gas Control Module, which allows to set up and monitor the Mass Flow Controller flow for each gas, and also manages the safety hardware interlocks.

The gas control could be manual or in a programmed sequence by using the Argus 771 Sequencer.

The system has 2 MFCs with the following maximum flow ranges:

Nitrogen 10 SLPM

Argon 10 SLPM

The wafer handling is manual: the quartz boat is introduced in the flat zone and extracted from the furnace with the help of quartz rods.

The system can be used for Polyamide cure or other organic materials processing.

SAFETY

High temperature: many furnace parts can be hot. Use the special heat resistant gloves to handle those parts

PROCEDURE.

- 1) "ENGAGE" the machine in CORAL for TRL tube "B3-DryOx" machine, before you start.
Your process have to be approved by PTC.
- 2) Load the wafers into the tube:
 - place the wafers into the assigned quartz boat for tubeA1, with the flat up and front side to face the clean room side, when introduced into the furnace. Place the boat on the quartz half shell handler.
 - check if the tube temperature is bellow 400C and remove the furnace end cap using the heat resistant gloves; place it face down on the SS wafer transfer table.
 - transport the quartz boat with the boat handler to the tube opening, and push the boat with the short quartz rod into the tube.
 - using the long quartz rod push the boat to the Center Zone of the flat temperature profile; the quartz has a mark that should be aligned to the edge of the tube scavenger, when the boat is in the Center Zone.
 - replace the end cap: take care not to push it too hard, and align its exhaust to the scavenger opening.
 - set the Nitrogen flow to 50%:
 - * select channel 1 using the Channel toggle switch on the Argus GCM, in MAN mode.
 - * increase the MFC set point to 50% by moving upward the Set Point toggle switch.
 - * push twice the Set Point button located bellow the display, to activate the set point, and the actual flow value will be displayed.
- 3) Set the process temperature profile:
The temperature controller has ramp/ up ramp down temperature operation capability.
 - a) Fixed temperature operation
 - on the Central Zone Eurotherm controller, adjust the set point to the process temperature value by using the arrow keys. The set point is for the heater thermocouples located outside the quartz tube and should be lower than 450C. Adjust the set point for the Load and Source zone controllers to a value between 10 and 20; these set points are relative to the Central zone controller set point .
 - on the main Omega DSP display, select channel #11 that correspond to the Central Zone profile Tc located inside the quartz tube, and wait for the temperature ramp up and stabilization.
 - on the Omega display check the Load zone (channel 10) and Source zone (channel 12) temperature

values and manually adjust the respective controllers set points to get a flat temperature profile; repeat these adjustments until all temperature values are within 2 degrees.

b) Ramp up/down temperature operation

Assume you need the following ramp up/ ramp down temperature sequence:

- from 200 C to 300 C ramp up with 5 C/minute
- steady state 30 min at 300C
- from 300C to 250 C ramp down with 3C/ minute
- steady state 60 min at 250C

Set the starting temperature at 200C as instructed above.

On the Central Zone master temperature controller do the following:

- push PAR button until you see "r1" and using the arrow key set it to 5 C/ minute
- push PAR button until you see "L" and using the arrow keys set it to 300C
- push PAR button until you see "d1" and using the arrow keys set it to 30 minutes
- push PAR button until you see "r2" and using the arrow keys set it to 3 C/minute.
- push PAR button until you see "L2" and using the arrow keys set it to 250C
- push PAR button until you see "d2" and using the arrow keys set it to 60 minutes.

The controller was programmed and is ready to run

4) Edit the process recipe on the 771 Sequencer:

- on the 771 Sequencer turn the key into the Program position, and push the MAN button, you are in program edit mode now.
- push the PROG SELECT button, and use the toggle switch to select the program number address (up to 5 programs) that you want to program.
- push the keys number : 1, 9 and 10
- push LOAD
- exit edit mode by pushing MAN
- turn the key from Program to LOCK position

5) Start the program

- Check if the starting system temperature profile is the one you need, and if it is stable.
- on the 771 Sequencer push the ENABLE button
- on the Center zone temperature controller, push PAR button twice, then using the arrow keys select RUN.

The temperature ramp up/ ramp down program starts. .

6) To unload the wafers do the following:

When the program ends, the system will remain at the process temperature with Nitrogen flow at 51%.

- on the 771 Sequencer, push the ENABLE button, to get the LED off.
- on the Center zone temperature controller push PAR button twice, and using the arrow keys, select IDLE.
- check if the tube temperature is below 400C and remove the furnace end cap using the heat resistant gloves; place it face down on the SS wafer transfer table.
- using the long quartz rod bring the quartz boat to the tube edge, then using the short quartz rod pull the quartz boat onto the boat handler and move them to the transfer table.
- install back the end cap with its exhaust aligned to the scavenger opening, and take care not to push it too hard as it may get stuck and difficult to remove later.

- set the N2 flow to 20 %.

7) End your session in CORAL, by "DISENGAGE" the machine after you input the measurement data in comments section.

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