



Lab Manual

[Marvell Nanolab](#)[Member login](#)[Lab Manual Index](#)[Mercury Web](#)[Berkeley Microlab](#)

Dummy Wafer Preparation & Rework for Tystar LPCVD Furnaces & Lam Etchers

1.0 Title

Dummy Wafer Preparation and Rework for Tystar LPCVD Furnaces and Lam Etchers

2.0 Purpose

To provide the detailed procedures of the dummy wafer preparation and rework for Tystar LPCVD furnaces and Lam etchers

3.0 Scope

This document includes the dummy wafer preparation and rework procedures for:
Tystar9, 10, 11, 12, 14, 16, 17, 19, and 20;
Lam1, 2, 3, 4, and 5.

4.0 Applicable Documents

[Revision History](#)

- 4.1 Microlab Online Manual [Chapter 2.6](#) – Sink6 Operation
- 4.2 Microlab Online Manual [Chapter 2.7](#) – Sink7 Operation
- 4.3 Microlab Online Manual [Chapter 2.8](#) – Sink8 Operation
- 4.4 Microlab Online Manual [Chapter 5.2](#) – Tystar2 Oxidation Furnace Operation
- 4.5 Microlab Online Manual Chapters [5.3/5.4](#) – Tystar3/4 Oxidation Furnace Operation
- 4.6 Microlab Online Manual [Chapter 5.16](#) – Tystar16 Poly-Si LPCVD Furnace Operation
- 4.7 Microlab Online Manual [Chapter 5.17](#) – Tystar17 Nitride LPCVD Furnace Operation

5.0 Definitions & Process Terminology

N/A

6.0 Safety

- 6.1 Wear protective face shield, apron, and chemical resistant gloves when working at a sink. Follow all the safety guidelines listed in the [Sink6 - 8](#) online manuals.
- 6.2 General Microlab safety procedures should be followed.

7.0 Statistical/Process Data

N/A

8.0 Available Processes, Chemical, Process Notes

- 8.1 Hydrofluoric Acid (HF): Used to remove silicon oxide. Concentrated HF (49%) can also be used to remove silicon nitride.
- 8.2 Buffered Oxide Etchant (BOE) or Buffered HF (BHF): Used to remove silicon oxide. It contains ammonia fluoride that will decompose to make up to fluorine ion consumed during etch process.

- 8.3 Phosphoric Acid: Used to remove silicon nitride film. The etch temperature is 160°C.
- 8.4 Silicon Etchant: A premixed solution, of nitric acid, HF, and DI water, used to etch poly-silicon. To increase the etch rate, the process temperature can be increased to 50°C.

9.0 Dummy Wafer Preparation & Rework Procedures

9.1 Dummy Wafer Type & Identification

All dummy wafers are test grade wafers. They should be properly scribed, on the backside near the flat, with the equipment name they are intended to be used. This identification is to prevent mixing up of different dummy wafers during rework procedures. Because all the dummy wafers will be processed in a Tystar furnace, mix up of MOS and non-MOS wafers will create a major contamination in the MOS clean furnaces.

Tystar9, 10, 11, and 19 are MOS clean furnaces and Tystar12, 14, 16, 17, and 20 are non-MOS. All the LAM etcher dummy wafers are considered non-MOS.

9.2 Tystar9 – MOS Silicon Nitride & High Temperature Oxide LPCVD Furnace

Dummy Wafer Preparation

- 9.2.1 Wafer Type: Test Grade Bare silicon wafers.
Quantity: 4"/25X; 6"/12X.
- 9.2.2 Clean the wafers in Sink6 (Piranha and HF dip).

Dummy Wafer Rework

- 9.2.3 In Sink7, etch the rework dummy wafers in concentrated HF (49%) until all the film is removed and the wafer surface de-wet. It may take hours, even over-night, depends on the film thickness. Increase the acid bath temperature, but not higher than 50°C, can increase the etch rate.
- 9.2.4 Quick Dump Rinse (QDR) the wafers, then Spin Rinse Dry (SRD).
- 9.2.5 Follow [Section 9.2.2](#) for final cleaning.

Note: Pure silicon nitride film can be stripped using hot phosphoric acid with excellent selectivity to the silicon substrate. However, Tystar9 all deposits high temperature oxide (HTO), which cannot be stripped by, hot phosphoric acid.

9.3 Tystar10 – MOS Polycrystalline and Amorphous Silicon LPCVD Furnace

Dummy Wafer Preparation

- 9.3.1 Wafer Type: Test Grade silicon wafer with 3kÅ of silicon oxide.
Quantity: 4"/30X; 6"/15X.
- 9.3.2 Clean the bare wafers in Sink6 (Piranha and HF dip).
- 9.3.3 In Tystar2, grow 3kÅ of silicon oxide using 2WETOXA recipe. Oxidation temperature is 1000°C and time is 45 minutes.

Dummy Wafer Rework

- 9.3.4 Check out 3 gallons of pre-mixed "silicon Etchant" from Room 432C. Or mix the solution using the following formula:
 - 4500 ml DI water
 - 4500 ml Nitric Acid
 - 200 ml HF (49%)

- 9.3.5 In Sink7, carefully pour the solution into the heated bath on the left hand inside corner. Set the bath temperature to 50°C. There is no need to wait for the temperature to stabilize to start etching the rework dummy wafers.
- 9.3.6 Check the etch process every five minutes. Since the poly-silicon film thickness on the dummy wafers vary significantly, some wafers may finished etching much sooner than the others. The Silicon Etchant will etch underlayer silicon oxide, though slowly. When the silicon oxide is consumed, it will start etching and destroy the silicon wafers.
- 9.3.7 When the poly-silicon film is etched away, the wafer shows the purple-blue color of the underlying oxide. After the poly-silicon film on some wafers are stripped off, QDR the whole cassette. Remove those wafers, and then put the cassette back to the Silicon Etchant solution. Repeat the process until all the wafers are done.
- 9.3.8 Follow [Sections 9.3.1 to 9.3.3](#) to prepare the reworked wafers.

9.4 Tystar11 – MOS Low Temperature Oxide (LTO/PSG) LPCVD Furnace

Dummy Wafer Preparation

- 9.4.1 Wafer Type: Test Grade Bare silicon wafers.
Quantity: 4"/30X; 6"/15X.
- 9.4.2 Clean the wafers in Sink6 (Piranha and HF dip).

Dummy Wafer Rework

- 9.4.3 Check the surface of the used dummy wafers. If the film on the surface is peeling off, discard the wafers.
- 9.4.4 Etch the dummy wafers in the BHF tank on Sink8 until all wafers de-wet.
- 9.4.5 Follow [Section 9.4.2](#) for final cleaning.

9.5 Tystar12 – Non-MOS Low Temperature Oxide (LTO/PSG) LPCVD Furnace

The procedures are the same as Tystar11 ([Section 9.4](#)). Dummy wafers from Tsytar11 and Tystar 12 furnaces can be reworked together. Make sure not to mix them up when loading into the furnaces.

9.6 Tystar14 – Boron Doping Atmospheric Furnace

Dummy Wafer Preparation

- 9.6.1 Wafer Type: Test Grade Bare silicon wafers.
Quantity: 4"/28X; 6"/14X.
- 9.6.2 Clean the wafers in Sink6 (Piranha and HF dip).

Dummy Wafer Rework

- 9.6.3 Oxidize the used dummy wafers in Tystar3/4 using 3WETOXA/4WETOXA recipe – temperature: 1000°C, time: 1 hour.
- 9.6.4 Etch the oxidized dummy wafers in the BHF tank on Sink8 until all wafers de-wet.

9.7 Tystar16 – Non-MOS Polycrystalline and Amorphous Silicon LPCVD Furnace

The procedures are the same as Tystar10 ([Section 9.3](#)). Dummy wafers from two different furnaces can be reworked together. Make sure not to mix up MOS and N0n-MOS dummy wafers when loading into the furnaces.

9.8 Tystar17 – Non-MOS Low Stress Nitride (LSN) LPCVD Furnace

Dummy Wafer Preparation

- 9.8.1 Wafer Type: Test Grade Bare silicon wafers.
Quantity: 4"/37X; 6"/12X.
- 9.8.2 Clean the wafers in Sink6 (Piranha and HF dip).

Dummy Wafer Rework

- 9.8.3 Used dummy wafers can be reworked following [Section 9.2.3 – 9.2.5](#), if the deposition is less than 10 microns. If the film looks rough and non-transparent, discard the wafers.

9.9 Tystar19 – MOS Silicon/Germanium LPCVD Furnace

The procedures are the same as Tystar10 ([Section 9.3](#)). The etch rate on the film varies due to various Germanium content. Check frequently during the etch process.

9.10 Tystar20

The procedures are the same as Tystar19 ([Section 9.9](#)). Dummy wafers from two different furnaces can be reworked together. But do not mix up MOS and N0n-MOS dummy wafers when loading into the furnaces.

9.11 Lam1Dummy Wafer Preparation

- 9.11.1 Wafer Type: Test Grade silicon wafer with 2kÅ of silicon nitride on 3kÅ of silicon oxide.
Wafer Size: 6".
- 9.11.2 Clean the bare wafers in Sink6 (Piranha and HF dip).
- 9.11.3 In Tystar3/4, grow 3kÅ of silicon oxide using 3WETOXA/4WETOXA recipe. Oxidation temperature is 1000°C and time is 45 minutes.
- 9.11.4 In Tystar17, grown 2kÅ of silicon oxide using STDNITA.017 recipe. Deposition time is 1 hour.

Dummy Wafer Rework

- 9.11.5 Dummy wafers should be used on both sides until the deep purple-bluish color of underlying silicon oxide shows up.
- 9.11.6 In Sink7, etch the rework dummy wafers in concentrated HF (49%) until all the film is removed and the wafer surface de-wet.
- 9.11.7 Follow [Section 9.11.2 – 9.11.4](#) to prepare the reworked dummy wafers.

9.12 Lam2Dummy Wafer Preparation

- 9.12.1 Wafer Type: Test Grade silicon wafer with 6kÅ of silicon oxide.
Wafer Size: 6".
- 9.12.2 Clean the bare wafers in Sink6 (Piranha and HF dip).
- 9.12.3 In Tystar3/4, grow 6kÅ of silicon oxide using 3WETOXA/4WETOXA recipe. Oxidation temperature is 1000°C and time is 2 hours.

Dummy Wafer Rework

- 9.12.4 Dummy wafers should be used on both sides until the silver color of underlying silicon shows up.

- 9.12.5 In Sink8, etch the rework dummy wafers in 5:1 BHF tank until all the film is removed and the wafer surface de-wet.
- 9.12.6 Follow [Section 9.12.2 – 9.12.3](#) to prepare the reworked dummy wafers.

9.13 Lam3

Dummy Wafer Preparation

- 9.13.1 Wafer Type: Test Grade silicon wafer with 6kÅ of aluminum film on 3kÅ of silicon oxide. Wafer Size: 4”.
- 9.13.2 Clean the bare wafers in Sink6 (Piranha and HF dip).
- 9.13.3 In Tystar3/4, grow 6kÅ of silicon oxide using 3WETOXA/4WETOXA recipe. Oxidation temperature is 1000°C and time is 45 minutes.
- 9.13.4 In CPA, deposit aluminum film using the following process parameters: 4.0 kW, 6 mtorr, and 20-cm/min speed, double runs.

Dummy Wafer Rework

- 9.13.5 Dummy wafers should be used until the deep purple-bluish color of underlying silicon oxide shows up.
- 9.13.6 In Sink8, etch the rework dummy wafers in Aluminum Etch tank until all the aluminum film is removed and the wafer shows the deep purple-bluish color of underlying silicon oxide completely.
- 9.13.7 QDR the dummy wafers, then etch them in 5:1 BHF tank until all the oxide film is removed and the wafer surface de-wet.
- 9.13.8 Follow [Section 9.13.2 – 9.13.4](#) to prepare the reworked dummy wafers.

9.14 Lam4

Dummy Wafer Preparation

- 9.14.1 Wafer Type: Test Grade silicon wafer with 6kÅ of undoped-poly-silicon film on 3kÅ of silicon oxide. Wafer Size: 4”.
- 9.14.2 Clean the bare wafers in Sink6 (Piranha and HF dip).
- 9.14.3 In Tystar3/4, grow 3 kÅ of silicon oxide using 3WETOXA/4WETOXA recipe. Oxidation temperature is 1000°C and time is 45 minutes.
- 9.14.4 In Tystar16, deposit undoped-poly-silicon film using 16SUPLYA recipe. Deposition time is 1 hour.

Dummy Wafer Rework

- 9.14.5 Dummy wafers should be used until the deep purple-bluish color of underlying silicon oxide shows up.
- 9.14.6 In Sink7, etch the rework dummy wafers in silicon etch solution (see [Section 9.3.4](#)) until all the poly-silicon film is removed and the wafer shows the deep purple-bluish color of underlying silicon oxide completely.
- 9.14.7 QDR the dummy wafers, then etch them in 5:1 BHF tank of Sink8 until all the oxide film is removed and the wafer surface de-wet.
- 9.14.8 Follow Section 9.14.2 – 9.14.4 to prepare the reworked dummy wafers.

9.15 Lam5

The procedures are the same as Lam4, except the wafer used is 6”.

10.0 Troubleshooting Guidelines

N/A

11.0 Figures & Schematics

N/A

12.0 Appendix

N/A