Chapter [8.25]

NANOSPEC-CMP

(nanospec-cmp) ***(Cory 190)***

1.0 Equipment Purpose

1.1 The nanospec-cmp is a Nanospec/AFT Model 010-0180 computerized local film thickness measurement system. It includes a microspectrophotometer head, which can measure in the wavelength range of 390 – 800 nm, using a computer-controlled grating monochromator, photomultiplier tube detector and amplifier.

1.2 This manual covers the materials used, process, operation and safety procedures for this tool.

2.0 Material Controls & Compatibility

2.1 The nanospec-cmp (Figure 1) is used to measure film thicknesses of 4” and 6” wafers processed on the CMP, both located in room 190 Cory. It is used to measure,

Oxide on Si

Nitride on Si

Neg Resist on Si

Poly-Si on 1000 Å of SiO_2

Neg Resist on SiO_2

Nitride on SiO_2 (10X objective only)

Thin Oxide on Si

Polyimide on Si

Positive Resist on Si

Positive Resist on SiO_2

3.0 Training Procedure & Applicable Documents

3.1 Member Qualify Tool

3.1.1 This tool may or may not require enabling for use

3.1.2 There are no prerequisites for this tool

3.1.3 Timeline (estimated time to completion: 1 day)

3.1.3.1 Train and qualify with any qualified member. All qualified members are superusers on these tools.

3.2 Nanospec/AFT, Model No. 010-10180 Instruction Manual Rev. 1. A copy is in the Nanolab Office.

4.0 Definitions & Process Terminology

4.1 N/A

5.0 Safety

5.1 Burn Hazard – the lamp is hot. Do not touch.

5.2 Bright light Hazard – Do not look directly into the light source.

6.0 Process Data

6.1 This tool is not monitored by staff

7.0 Available Processes, Gases, Process Notes

7.1 Standard programs set up by the vendor of the materials given in Section 2.0 may be measured.

7.2 In order to measure the film thickness, the refractive index of the film is needed. The user may use the default value stored in the computer measurement recipe or enter it when the recipe requests it.

8.0 Equipment Operation

8.1 When you come to the tool, the “AVAILABLE FILMS” menu should be displayed. If not, Press <Calib><Enter>. ***NANOSPEC/AFT*** will be displayed with the question, “**SWITCH TO PRINTER?**” Press <No>, and the “AVAILABLE FILMS” menu will be displayed.

8.2 To measure a film, use the following recipe,

*** NANOSPEC / AFT ***

SWITCH TO PRINTER ?

Press <No>

AVAILABLE FILMS:

1 OXIDE ON SI
2 NITRIDE ON SI
3 NEG RESIST ON SI
4 POLYSILICON ON 1000A SIO2
5 NEG RESIST ON SIO2
6 NITRIDE ON SIO2 10X
7 THIN OXIDE ON SI
8 THIN NITRIDE ON SI
9 POLYIMIDE ON SI
10 POS RESIST ON SI
11 POS RESIST ON SIO2

ENTER FILM TYPE

Press <keypad 1> <Enter>

ENTER OBJ LENS
1 = 10X 2 = 40X 3 = 100X

Use the 10X objective lens unless the oxidized area that you want to measure is so small that it must be viewed with the 40X objective in order for it to appear to be larger than the "entrance aperture" (the dark spot in the center of the field of view). This script assumes that the 10X objective is used.

Press <keypad 1> <Enter>

1 OXIDE ON SI
10X OBJECTIVE

Wait while the wavelength counter changes from 480 nm down to 350 nm and then back to 480 nm

NEW REF WAFER ?

Press <y>

Place a clean bare silicon wafer on the left stage position and move the wafer under the microscope.

Push the filter holder all the way to the right so that the yellow filter is in place (except for programs 7 & 8).

Turn the field diaphragm control "F" completely clockwise so that the diaphragm opening is as small as possible. (This provides an image on which to focus.)

Confirm that the Wavelength = 480 nm. If the wavelength is not 480 nm, the Nanospec must be turned off and then turned on again and the start-up procedure (described elsewhere) must be followed.

Check the amplifier "zero" by rotating the microscope turret to a position between objective lenses so that light is blocked. The photo-intensity meter reading should be between +0.5 and +1.0. If you must adjust the "Zero" control, make small changes and wait 30 minutes for the instrument to stabilize.

Check the "gain" by rotating the microscope turret to the 10X objective lens position and focusing on the field diaphragm image. The photo-intensity meter reading should be between +31 and +32. If you must adjust the "Fine Gain" control, make small changes and wait 30 minutes for the instrument to stabilize. If you need to use the 40X objective lens for your measurements (and you entered "2" earlier to identify the 40X objective lens), rotate the turret to the 40X objective lens position after you have adjusted the gain.

FOCUS ON REF WAFER
THEN PUSH MEASURE
WAITING

Focus on the image of the diaphragm. Then press <Meas>.

M

Do not bump the instrument while it is scanning.

ENTER SAMPLE #

This entry is optional; just press <Enter> to continue

ENTER REFRACTIVE INDEX

Usually use the default value by pressing <Enter>

REFR INDEX = 1.45

PLS FOCUS SAMPLE
THEN PUSH MEASURE

SEQ # THICKNESS
WAITING

Place the oxidized silicon wafer on the right stage position and move the oxidized wafer under the microscope so that the desired location on the wafer is beneath the objective lens.

Focus on the image of the diaphragm. The oxidized area should appear to be larger than the entrance aperture (the dark spot in the center of the field of view). Then press <Meas>.

M

Do not bump the instrument while it is scanning.

1 1250 A
WAITING

Move the oxidized wafer under the microscope so that the next location on the wafer is beneath the objective lens. Focus on the image of the diaphragm. Then press <Meas>.

M

Do not bump the instrument while it is scanning.

2 1236 A
WAITING

Continue measuring oxide thickness at the desired positions on the wafer. If you need to change the objective lens, you will have to scan a new reference wafer. This can be initiated by pressing <Calib> <Enter> and following the prompts.

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When you have finished your measurements you should restore the "AVAILABLE FILMS" menu.
Press <Calib> <Enter>.

*** NANOSPEC / AFT ***

SWITCH TO PRINTER ?

Press <No>

The "AVAILABLE FILMS" menu will be displayed.

8.3 ***Obtaining Statistics from the Nanospec-cmp***

During the measurement procedure, the tool will ask you to enter a DataBank #. You can enter 1 - 16 to collect data on a given series of measurements.

After you enter a DataBank #, take a measurement. The thickness will be given, followed by, "STORE DATA?" Answer with the <YES> or <NO> key. If <YES>, the DataBank will indicate that that it accepted this value. If <NO>, "DATA IGNORED" will be given and the DataBank will not be affected by this value.

After you enter a DataBank #, take a measurement. The thickness will be given, followed by, "STORE DATA?" Answer with the <YES> or <NO> key. If <YES>, the DataBank will indicate that that it accepted this value. If <NO>, "DATA IGNORED" will be given and the DataBank will not be affected by this value.

To recall data from the DataBank, Hold "CALIB" key for longer than a moment - say 2 - 3 secs. When you see "ENTER FILM TYPE" on the screen, Enter "250" and press <ENTER>.

You have five choices,

EXIT STATS PRGM

PRINT STATS

RESET STATS

RESET ALL STATS

PRINT GLOBALS

EXIT returns you to the normal measurement program

PRINT STATS - Type "1", press <ENTER>, then type the number of the file to be printed and press <ENTER> again.

RESET STATS - resets one DataBank file. Type "2" and press <ENTER>, then type the # of the file to be reset to zero and <ENTER>.

RESET ALL STATS - resets all the data files. Type "3" then <ENTER>. Then type"197", press <ENTER> to reset all of the stats to zero.

PRINT GLOBALS - prints min and max of all data entries in the DataBank. The mean given will be the mean of all the means computed. All files with no data are excluded.

9.0 Troubleshooting Guidelines

9.1 Problem: No light in the microscope – bulb burned out, report on wand.

9.2 Problem: Computer does not respond to keyboard – locate the power switch on the lower left hand corner at the back of the computer on the bottom shelf, and turn it off. Locate the microscope light switch on the upper right hand corner and turn it off. Next, turn on the power switch, wait five seconds, and then turn on the light switch. If this does not work, report the problem on the wand.

9.3 Problem: Values obtained are inaccurate – recalibrate with a clean reference wafer.

10.0 Study Guide

10.1 What are the parameters for measurement of recipe 4, the poly-Si/oxide measurement?
10.2 Do you need a clean reference wafer?
10.3 Do you need the refractive index to perform a film thickness measurement?
10.4 How do you check the gain?
10.5 What should the photo-intensity meter read for accurate measurements?

11.0 Figures & Schematics

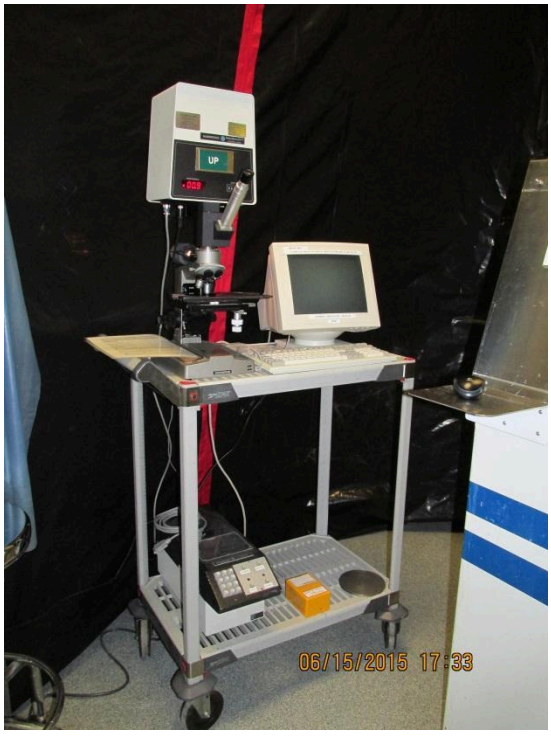

Figure 1, nanospeccmp