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Nanospec - Standard Operating Procedure

Badger Name:	P2 Ellipsometer Nanospec	**Revision Number:** 5
Model:	200	**Revisionist:** Wanjohi Kimani
Location:	PAN Bay2	**Date:** March 30, 2020

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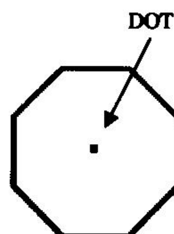
1. Scope

1.1 This document provides detailed instructions on how to properly operate the Oxygen Asher.

2. Tool Description

2.1 The NANOSPEC/AFT is a computerized film thickness measurement system. The Nanospec separates light from a white source into its component wavelengths, from 480 to 800 nanometers. The interference of the light waves is then measured using several algorithms and thickness is determined. This instrument offers programs on thirteen specific film types, relative reflectance, and multipurpose thick film capability. A dielectric film in the range of the instrument extends from less than 100Å to 40,000Å, with a reflectivity of +/-2% to +/- 5%. The following table lists measurement beam size vs. objective:

Lens	Dot Size (μm)
5x	70
10x	35
40x	14
100x	3.5



3. Safety

3.1 Avoid eye contact with the laser to prevent eye damage.

4. Restrictions/Requirements

4.1 Must be a qualified user

4.2 The substrate cannot be transparent

5. Required Facilities

6. Definitions

6.1 Reference wafer: A bare silicon wafer

7. Setup

7.1 Load a bare silicon wafer on the stage and focus on it.

7.2 To calibrate the system, hold [Ctrl] and type “RESET”

7.3 Follow the instructions on the screen:

7.3.1 Check the wavelength above the microscope (Is it 480nm?)

7.3.2 If it is, press [Y] on the keyboard

7.3.3 If not, press [N] on the keyboard and enter the number shown on the counter. Repeat if necessary.

7.4 REFR INDEX OPTION? [Y] or [N] depending on whether you know your film’s refractive index or not

7.5 ENABLE PRINTER OPTION? [N]

7.6 Rotate lens to eliminate light. Move the lens so it is between objectives.

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7.7 *Adjust **ZERO** to 0.5 - 1.0*. There is a dial labeled **ZERO** underneath the wavelength readout above the stage. Turn the knob until the led on the left reads the correct number.

7.8 Focus on reference with 10 x objective.
While looking into the eyepiece, focus on the wafer. If it is **NOT** focused, a large round spot with blurred edges is seen. Using the focus adjustment knobs located on the front right corner of the microscope stand (next to the ZERO dial), focus until the circle with the blurred edges turns into an octagon. Adjust the GAIN control so the photo intensity meter reads between **31.0 -32.0**.

7.9 Press [RETURN]

8. Operating Instructions

8.1 Calibration should begin immediately, if not, press [F1] for calibration

8.2 Enter Film Type. Select the number correlating to the film that is to be measured. Press [Return]

8.3 Enter OBJ Lens. 1 = 10x, 2 = 40x, 3 = 100x

8.4 Focus on Reference Wafer. The measurement occurs in the area inside the black dot. Press [M] or F3 for measure.

8.5 Enter Sample #. This is optional and unnecessary; Measurements cannot be stored or restored. Press [Return] or [Enter] will take you to the next screen, even if no sample # was entered

8.6 Focus on Sample. Press [M] or F3 to measure

8.7 Enter the Ref Index: You may type a refractive index or press [Return] for the default refractive index for the film selected

8.8 For repeated measurements, press [M] or [F3] after accepting or rejecting the previous measurement (by pressing [YES] or [NO]).

8.9 Press [F1] to calibrate for a new set of data.

9. Problems/Troubleshooting

9.1 If the sample is not flat enough, it is necessary to adjust the gain while taking the measurements over the samples surface. If the sample cannot be measured, one of the following messages will be displayed: UNDER RANGE, LESS THAN 100Å, OVER RANGE, LESS THAN 20Å. The measurement will automatically be rejected.

9.2 An asterisk "*" next to the measured value means that a secondary algorithm was used, but the value is still viable

9.3 A question mark “?” means that the secondary algorithm was used, but a reliable answer was not reached, and the system has low confidence in the accuracy of the displayed value

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10. Appendix

10.1 **Nanospec Film types and thickness range**

Std. Prog No.	Film Type	Range, Angstroms Min	Max	Repeat-ability	Silicon Dioxide Thickness	Refractive Index
1	Silicon Dioxide on Silicon	400	40,000	±2%	---	1.45
2	Silicon Nitride on Silicon	400	10,000	±2%	---	2.00
3	Negative Resist on Silicon	500	40,000	±5%	---	1.55
4	Polysilicon on Silicon Dioxide	400	10,000	±2%	300-1,200	3.00
5	Negative Resist on Silicon Dioxide	4,000	30,000	±5%	500-15,000	1.55
6	Silicon Nitride on Silicon Dioxide*	300	3,500	±5%	300-3,500	2.00
7	Thin Oxide on Silicon	<100	500	±5 A	---	1.45
8	Thin Nitride on Silicon	<100	500	±5 A	---	2.00
9	Polyimide on Silicon	500	40,000	±5%	---	1.78
10	Positive Resist on Silicon	500	40,000	±5%	---	1.64
11	Positive Resist on Silicon Dioxide	4,000	30,000	±5%	500-15,000	1.64
12	Reflectance Mode*	370-800 nm		±2%	---	N/A
13	Thick Films**	4-40 microns		±5%	---	***

* 10X objective only

** 5X or 10X objective only (depending upon thickness)

*** Operator must input refractive index value. Default is 1.00.

Table 4.4-1. Film Types