University of Minnesota Nano Center

Rudolf ellipsometer - Standard Operating Procedure

Badger Name:	P1 Ellipsometer Rudolf	**Revision Number**:	5
Model:	MS14C2C	**Revisionist:**	Wanjohi Kimani
Location:	PAN bay1	**Date:**	March 31, 2020

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1. Scope

1.1 This document provides detailed instructions on how to properly operate the Rudolf ellipsometer.

2. Tool Description

2.1 Ellipsometry is a non-destructive method of measuring the index of refraction and film thickness of a dielectric film on a reflecting substrate. It is a highly accurate and repeatable measurement. Ellipsometry involves illuminating the surface of a sample with monochromatic light having a known and controllable state of polarization and analyzing the polarization state of the reflected light. The wavelength of the laser is 632.8 nm. The laser size is 0.025 x 0.075 mm.

Figure 1

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 Do not over tighten the three leveling knobs (jack screws) tighter than just a mild snug. You should not need to adjust the knobs more than a half turn.

4.3 Do not turn the micrometers until they are maximized. The stage will collide with the Polarizer module or the Analyzer module.

4.4 The compensator should remain in the DOWN position.

5 Required Facilities

6 Definitions

6.1 **TL** is Thickness Lower level of a multi layered film, **TU** is thickness Upper

6.2 **NL** is Refractive Index Lower level of a multi layered film, **NU** is Refractive Index Upper

6.3 **KL** is extinction Index Lower level of a multi-layered film, **NU** is extinction Index Upper

6.4 **NS** and **KS** are **N** and **K** values for the substrate.

7 Setup

7.1 Place your wafer on the sample measuring stage.

7.2 Adjust the sample tilt, orient the analyzer module and orient the polarizer. This is accomplished by viewing the area through the optics and rotating the left and right and front circular knobs until the white spot is centered within the prism (Figure 2). Do not over tighten the three leveling knobs (jackscrews) tighter than just a mild snug. You should not need to adjust the knobs more than a half turn.

7.3 Move your wafer until the area you will be measuring is in view. If the laser light is visible, you can use it as an aid in positioning.

7.4 You may need to double click the "Tera Term" Pro icon if the Rudolf results screen is not on the RUDOLF monitor.

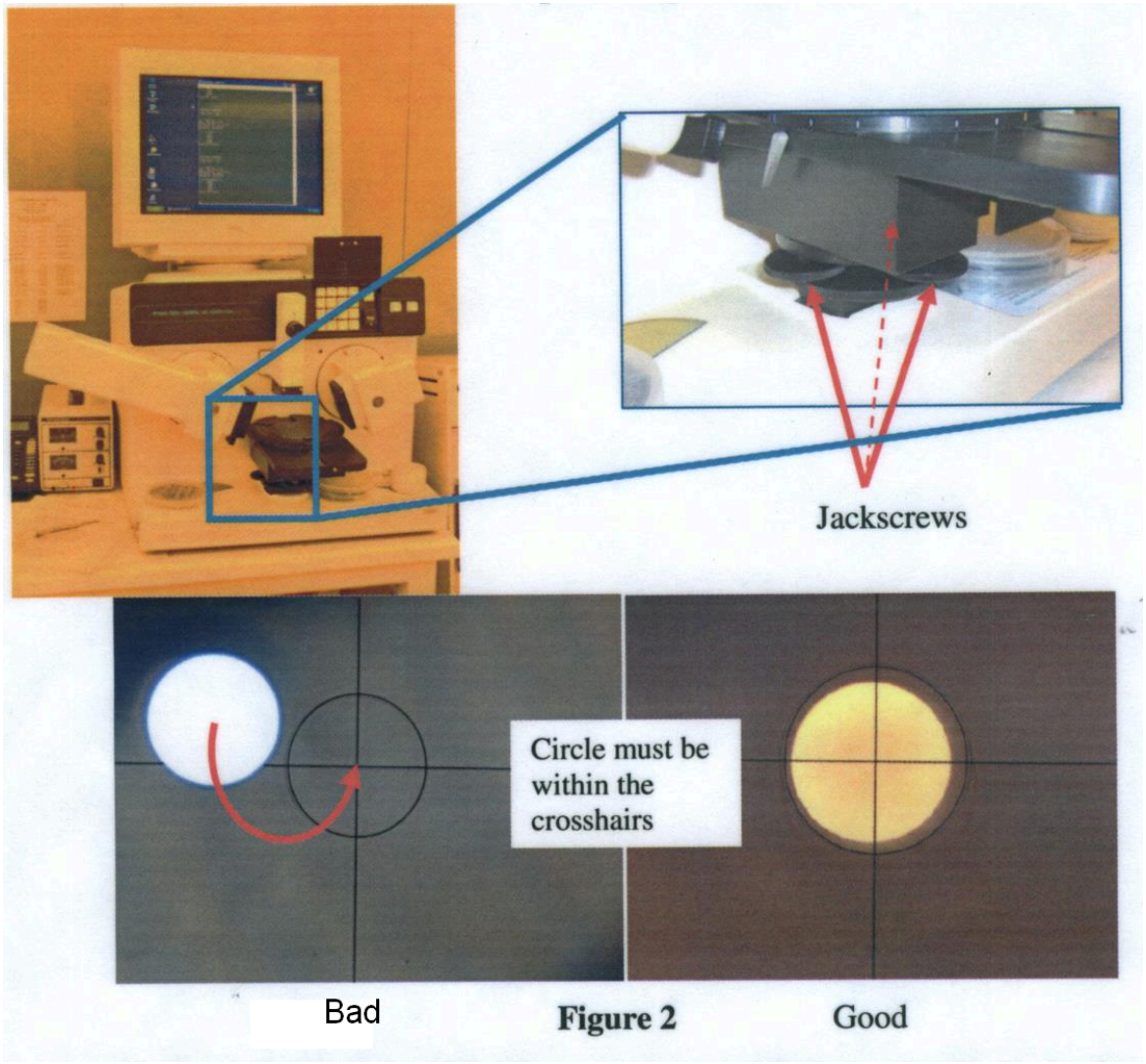

Figure 2

8 Operating Instructions

8.1 After the wafer is aligned, measurements can begin. Press the **RUN** button. Select the program from the table below by pressing the program number and press **ENTER** button.

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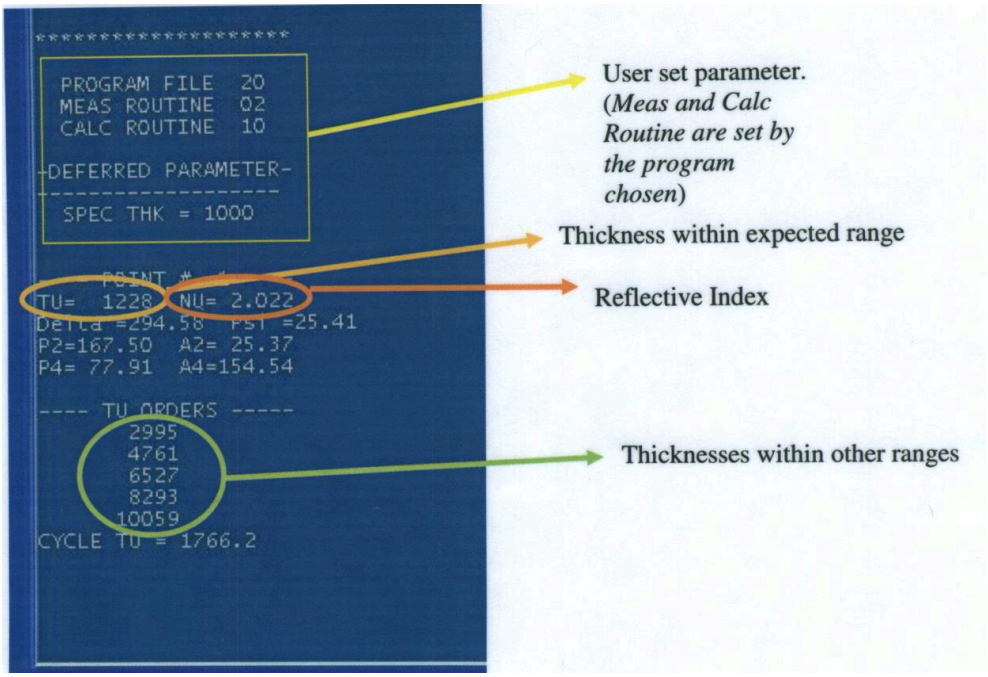
PROGRAM		USER INPUT	OUTPUT
Single layer	19	Sample I.D.	TU and NU
	20	Spec thickness	TU and NU
	21	Spec thickness, NU	TU
	22	Spec thickness	TU and NU
Double layer	32	Spec thickness upper layer, TL, NL	Spec thickness upper layer, TL
	33	Spec thickness, upper layer, TL, NL	Spec thickness upper layer, NL

8.2 Answer the necessary questions.
8.3 Once the system has all the needed items it will run the measurement program.
8.4 Push the **CONT** button for further measurements if using the same program.
8.5 The data listing may contain many lines of numbers. The important item is TU i.e. the thickness of the film being measured.
8.6 All other **TU ORDERS** list other orders of thickness that are also possible. Select the correct film thickness. Reconfirm the thickness by using the Nanospec.



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.