# University of MN, Minnesota Nano Center

Standard Operating Procedure

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|---|---|---|---|
| **Equipment Name:** | Gaertner ellipsometer | | |
| **Badger Name:** | ellipsometer-g | **Revision Number:** | 3 |
| **Model:** | L116A | **Revisionist**: | Paul Kimani |
| **Location:** | Bay 2 | **Date:** | October 21, 2013 |

1. **Description**
   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.
2. **Safety**
   - **a.** Avoid eye contact with the laser to prevent eye damage.
3. **Restrictions/Requirements**
   - a. Must be a qualified user
   - **b.** The substrate cannot be transparent.
4. **Required Facilities**
5. **Definitions**
6. **Setup**
   - a. “Wake up” the computer by moving the mouse or pressing the space bar.
   - b. If the application is not open, click on the icon labeled ‘Ellipsometer’.
   - c. Select the ‘continue’ button on the next two screens.
   - **d.** Single click on the menu icon which depicts the ellipsometer.
7. **Operating Instructions**
   - a. Place the sample in the middle of the stage with tweezers.
   - b. For fine positioning, adjust the **x, y** - micrometers located to the right and to the front of the stage.
   - c. For gross positing, move the wafer to a new location on the stage.
   - d. Pull the laser shutter (beam attenuator) outward on the laser tube located to the left of the stage.
   - e. Move the **Mode** switch, located on the right, to the **AS** position.
   - f. Adjust the stage height by rotating the height adjustment wheel located at the rear of the stage until the meter reading is maximized. (Clockwise rotation raises table; counterclockwise rotation lowers table). Adjust **GAIN** control as necessary to keep reading within the range 50 to 100 while obtaining maximum reading (especially keep the gain below 125 to avoid saturation)
   - g. Slowly rotate the analyzer to obtain maximum reading on meter, adjusting **GAIN** control as necessary to keep reading within the range 50 to 100 while obtaining maximum reading.
   - h. Move the **Mode** switch, located on the right, to the **A** position.

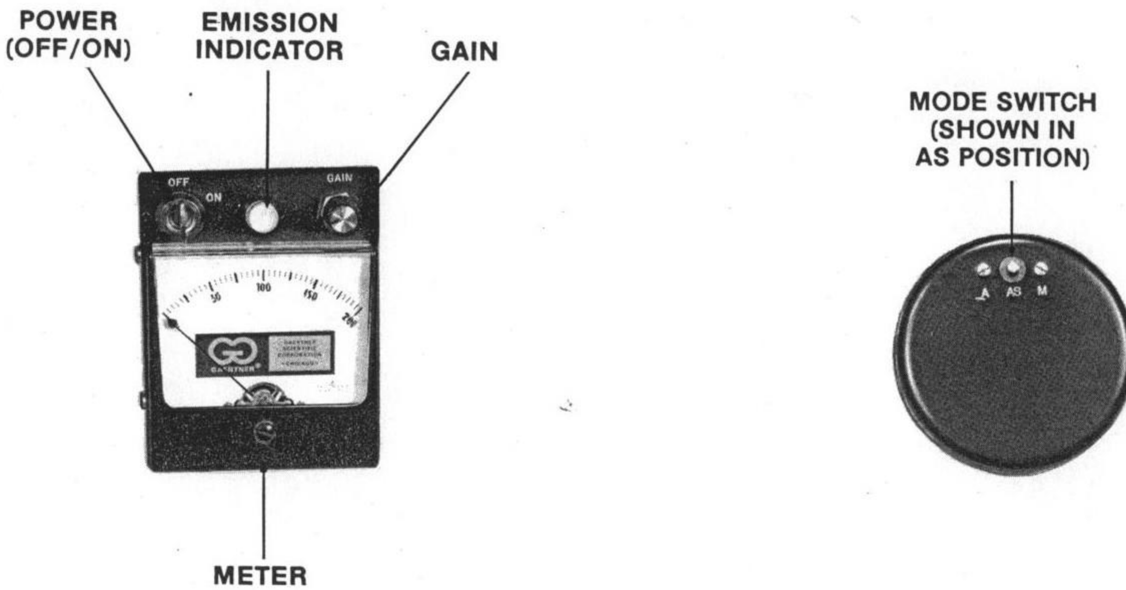


**Figure 1: Operating controls and indicators**

i. Select **'Load New Setup File'** button on the computer.
j. Choose the appropriate recipe. If no recipe can be found for the film type you are working on, choose a similar recipe. Any of the recipes can be modified to suit your particular film and saved as a new file.
k. Choose an appropriate calculation mode. The usual is **Thickness1** and **Nf1** which is Thickness and Refractive Index.
l. Select the **'Measure and Calculation'** button.
m. To view the periodical solution set of the thickness, single click on the **'Listing'** button. The data will be displayed on the window behind the 'Measurement and Calculation' window. Subsequent solution sets of data can also be added to this window. To save the accumulated data you will have to close the Measurement and Calculation' window (the data in 'Measurement and Calculation' will be lost) and then perform a 'Save As' command from the File menu.
n. To continue making measurements restore the 'Measurement and Calculation' window by single clicking on the icon which depicts the ellipsometer.
o. When the measurements are complete, close the laser shutter (beam attenuator) by pushing it inwards.

8. **Problems/Troubleshooting**
   a. If the sample is not flat enough, it is necessary to adjust the gain while taking the measurements over the samples surface.

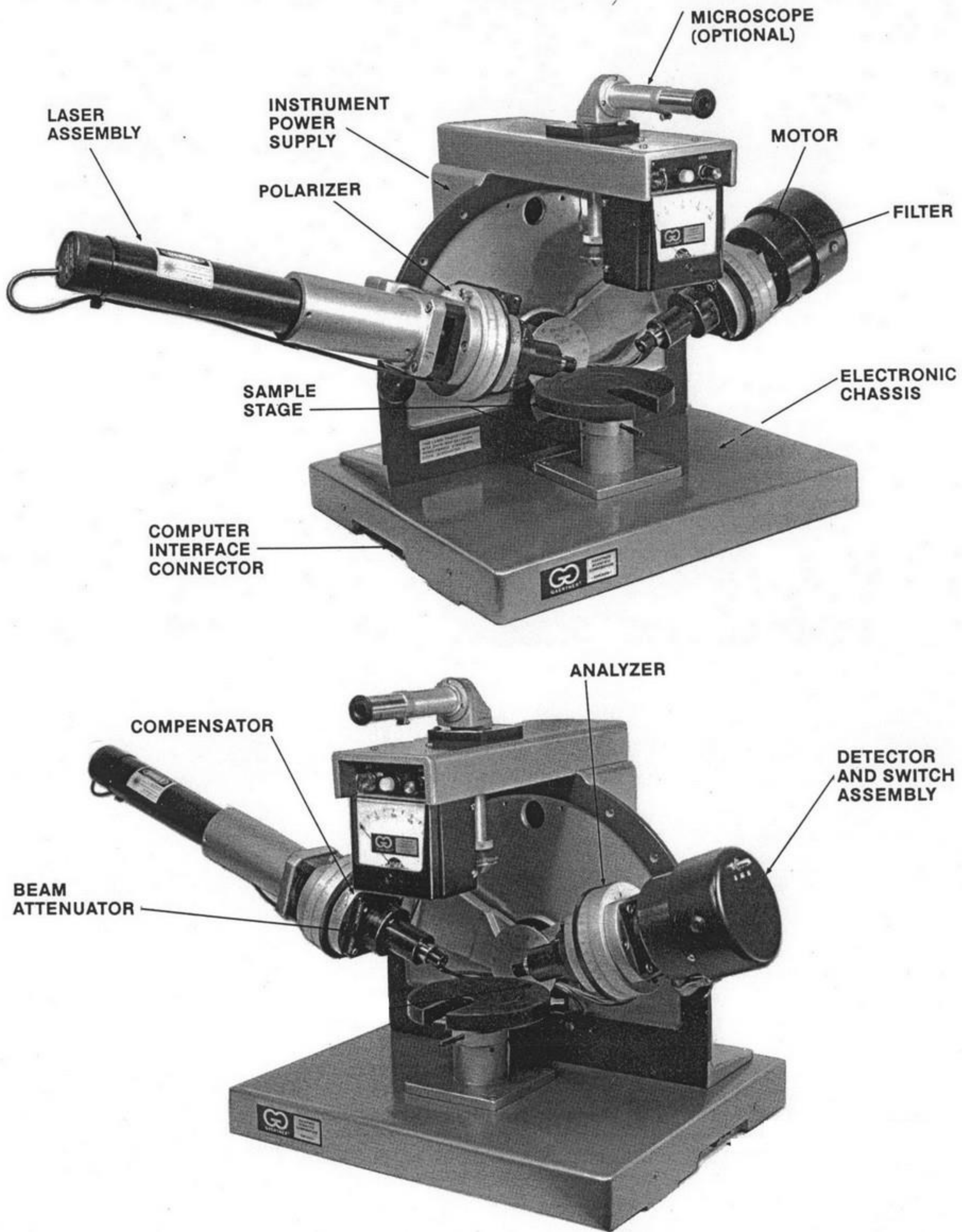


**Figure 2: Gaertner ellipsometer component identification**