

# INSTRUCTIONS FOR ELLIPSOMETER

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## ***CALIBRATION PROCEDURE:***

1. Start by turning the key on the left hand side of the base. Switch from “**standby**” to “**run**”. If the ellipsometer is found “**on**”, switch into the “**standby**” mode and turn the ellipsometer “**off**” and “**on**” with the key.
2. Get the computer ready:
  - Turn on computer and monitor.
  - Type “**cd\ellips**” to enter the program directory.
  - Type “**dafibm2**” which executes the program.
3. Set up to measure one of the standard wafers (suggested the one whose oxide is 1149 Å thick). Place this wafer on the ellipsometer stage with the written side facing up. Then:
  - Pull left lever to the white dot for calibration.
  - Center the light spot on the wafer in the center box using scrap of paper.
  - Level the sample by looking through the eyepiece and centering the white dot within the circle using the black dials beneath the stage.
  - Hit the “**CONT**” button, and screen will read “*initialization program*”.
  - When calibration is complete, switch the left lever back to the red dot.
  - Measure standard silicon wafer by hitting “**CONT**” again.
  - Check that the value calculated by the computer agrees with the known thickness.
  - Remove the standard wafer and store it face down in the storage case.

## **MEASUREMENT PROCEDURE:**

1. In the program you will find:

A	Ambient environment	N	Index of refraction
U	Upper Layer	K	Evanescent Length
L	Lower Layer		
S	Substrate		
Phi0	Angle of Incidence=70 deg		
Lambda	Characteristic wavelength for this ellipsometer: 6328.0 A		

For example, the index of refraction of the substrate will be labelled NS.

- To measure the thickness and refraction index of a single layer: set TL to zero. To do this, tab to this setting, type “**m**”, and enter zero. This will switch the program to the single layer mode.
  - Pick the parameter to iterate. The program is set up to iterate the thickness of the layer, but you must set it up manually to iterate the index of refraction. To do this, get to NU and type “**i**” to iterate. Also, change this value to 2, by typing “**m**” and the number “**2**”. The ambient environment, or air, must be set to have “ $NA = 1$ ”.
  - KU for SiO<sub>2</sub> (or whatever the upper layer is) is not important to change unless you need very good precision ( $< 10 \text{ \AA}$ ). If this is the case, then you need to look this up.
  - TU is the thickness of the upper layer which we do not know. Here, take a good guess which should be included in the limits defined below. For our case, starting guess is 4500  $\text{\AA}$ . We set the range below to be 800-6000, so that the thickness of both the standard and our chip can be calculated with the same program settings.
  - XX is the range for the iterated parameter. In this case, this is the index of refraction of the top layer. Set this to be min=1.25, max=3, and the step size is 0.001.
2. Put sample to be measured on the stage. Do the same process of centering and leveling the sample as listed above.
  3. Start up the program by typing “**g**” for go.
  4. Hit the “**CONT**” button. It will measure the sample and return values for Delta and Psi.
  5. These data will be transferred to the program which will produce multiple answers for the thickness and the index of refraction, so you need to have a good idea of what the answer should be to pick the correct value.
  6. Measurement can be repeated in different positions to get a measurement average and error.
  7. To finish with the computer program, type “**M**” to return to the main menu and then type “**q**” to quit. Turn off the monitor but leave the computer on.
  8. Turn off the ellipsometer.