ellipsometerTRL

STANDARD OPERATING PROCEDURE

CORAL Name: *ellipsometerTRL*

Model Number: Gaertner L117 Elipsometer

Location: TRL

What it does: --

Introduction: Ellipsometers work by sending an elliptical pattern of polarized light at a sample and measuring the characteristics of the reflected light. This tool can be used to measure a deposited or grown film refractive index (nf) and thickness of a uniform, semi-transparent film, typically on a single crystal silicon wafer. The minimum spot size needed for measurements is about 2mm. You need to have an approximate idea of the film thickness before starting [eg, from a surface profilometer measurement of the film or your target deposition thickness], as there will be an inherent standing wave with a fixed repeating period. Thus, you may be given a result of 1700A with a period of 3300A, so your film could be any of 1700A, 5000, 8300, or higher. All measurement units given are in angstroms on this machine- note; the units are never displayed at the terminal.

Safety: Ellipsometers' polarized light source is a **laser** of 6328A wavelength. Always wear safety glasses in TRL and when Using any laser. Either turn the laser off with the key or to push closed the laser shutter, the 1 cm black tab at the laser output (which says pull to open) when making any adjustments to either the polarizer/laser **or** the analyzer, as if it is moved, the laser continues outside of the tool confinement area. Be careful not to let your substrate act as a mirror and bounce the beam outside the normal reflection path.

Procedure: **(A) Standby Condition and Warm Up**

Standby Conditions:

(1) Computer (Dell optiplex 466) "ON", it *never* gets turned off

• Key (top, right of eyepiece) "OFF"

• Laser tab out "OPEN"

• The Polarizer and Analyzer are at 70 degrees angle to the stage, and the black angle lock screws are fairly tight

• The Polarizer is fixed at 45 degrees and the Analyzer switch is set to "A" so it spins when the key is turned on

Warm Up:

The first thing to do is turn the Key "ON" as the laser needs 10-20 min to warm up. Measurements taken before this time tend to report an incorrectly low nf. The right analyzer should start spinning, if not, switch the right toggle switch on.

(B) Preparation

This machine is very sensitive to stage height and stage level. While the laser is warming up, put

your sample or a dummy sample of the same thickness on the chuck, and adjust the stage:

• Set the stage height to maximize the light received by the analyzer, as displayed on the LED light meter by the eyepiece, by turning the 1 ½" black knurled knob on the chuck shank, raising or lowering the stage, while preventing the wafer chuck from spinning with the other hand.

• Set the stage level by viewing the eyepiece crosshair (rotate the silver 1cm cylinders to display the crosshair, if necessary), by turning the 1cm, black "x" and "y" height adjustment knobs, until the crosshair is centered correctly upon the "X" target pattern. Turn this light off when done

• Re-check stage height after adjustments.

(C) Operating Procedures

Engage ellipsometerTRL in CORAL.

This machine is not gold (Au) contaminated; Au samples may not be placed directly on the chuck, but must have a fabwipe, a dummy non-Au wafer, or clean glass slides to separate it from the substrate.

The CRT should display a menu prompting a function key entry. If it displays C:, you will need to type autoexec.bat. Never turn the Dell Optiplex 466 computer off as it is very difficult to boot up successfully.

The uppermost function menu has F key choices: **F1** , for generic **Film** measurement; F2 for oxide or nitride **Specific** film measurements, fixing Nf at either 1.46 or 2.0, F3 for **Substrate** Ns and Ks measurement, F4 for a **Two Angle** measurement, which requires Ellipsometer adjustments, and F10 is Exit the program (don't!).

Program **Film** , the normal selection, has default values of: Ns - 3.85, Ks - .02, WL 6328, nf (variable, 1.46 for ox to 2 for nitride), phi - 70, pol - 45. **F5** is **measure** thickness and nf, F6 is **list** the possible thickness solutions to choose from amongst, F7 is **setup** , for changing defaults, and F10 is **exit** to uppermost menu.

Find an area of your wafer with at least 1mm square of homogeneous film to be measured, and align the spot to this area with the eyepiece light on. Make sure the analyzer is spinning and no dust is being reflected by the laser, then press **F5** , if in the **Film** program. Results displayed will be thickness with the repeating additional periodicity and nf.

(D) Shutdown

When done, turn the optic/laser key OFF and disengage in CORAL. Make sure nothing but the computer is still on unless you are coming back again the same day; then it ok to leave the laser on, but close the shutter and turn off the analyzer drum.

Author:Kurt Broderick, 2/04