Variable Angle Laser Ellipsometer

ELIPSOMETER

Model No: HO-VALE-01

Ellipsometry is a very sensitive optical technique which provides unequalled capabilities for thin film metrology. Ellipsometry exploits phase information and polarization state of light and so can achieve angstrom level resolution. The main advantages of ellipsometry are its non-destructive character, high sensitivity and wide measurement range. HO-VALE-01 model is suitable for educational purpose and the optical parameters like thickness and refractive indices of a single layer thin film can be determined precisely. In the ellipsometer model HO-VALE-01, a circularly polarized light is made incident on the test substrate and the reflected light which is linearly polarized is analyzed for polarization changes.

The instrument consists of two concentrically rotating arms around a precisely graduated disc that is fixed to a heavy base. The Laser, Polarizer, and Quarter wave plate are mounted on the laser arm, whereas the analyser and the detector are mounted on the detector arm. The two arms can be positioned to set the incident angle between 30 and 90 degrees with a resolution of 0.1 degree. The Polarizer, Analyzer, and the Quarter-Wave plate are mounted in precision rotary stages that are 360° rotatable with a resolution of 0.1°. Linear glass polarizers are used for both polarizer and analyser. Sample is placed on a precision micrometer driven vertical stage with height adjustment range of 10 mm and resolution 0.01 mm. For null method, detector can be replaced with a miniature screen for visual determination of null point, if required.

Specifications

Measurement Range	50 nm - 300 nm
Incident Angle	30° ~ 90°, Error ≤ 0.1°
Laser	DPSS (532 nm, 5 mW)
Detector	Si Photodiode (5.8 mm x 5.8 mm)
Rotation Range	
Polarizer	0° - 360°
Quarter-Wave	0° - 360°
Resolution	0.1 degree
Source Arm	
Rotation Range	70 degrees (from horizontal plane)
Main Scale Division	1 degree
Resolution	0.1 degree
Detector Arm	
Rotation Range	70 degrees (from horizontal plane)
Main Scale Division	1 degree
Resolution	0.1 degree
Sample Holder	
Height Adjustment Range	10 mm
Resolution	10 microns
Tilting Range	+/- 2 degree

Principle of Ellipsometry

Ellipsometry is a highly sensitive optical measurement technique for optical thin films. The principle relies on the analysis of the change in the polarization state of light reflected from a surface. The change in the polarization of light reflected from the thin film surface is measured by taking the amplitude ratio of two perpendicularly polarized beams.

$$p = rp / rs = \tan \Psi e^{i\Delta}$$

Where Ψ and Δ are the amplitude ratio and phase shift of the p and s components respectively. Since ellipsometry is measuring the ratio of two values, it is very accurate and reproducible.

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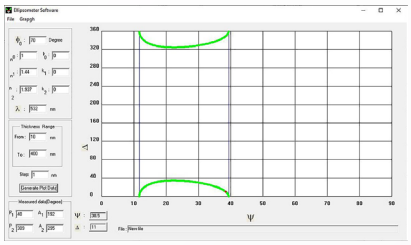
Software



Ellipsometer operation

As shown in the Fig., a randomly polarized laser light (532nm) passes through a polarizer which changes the polarization of light from random polarization to linear polarization. The linearly polarized light then passes through a quarter-wave plate (set the fast axis at 45 degree) which changes the polarization state from linear to circular. After reflection from the sample thin film, the circularly polarized light becomes linearly polarized and an analyzer measures the degree of polarization. A software will be used to find out the thickness and refractive index from the measured data.