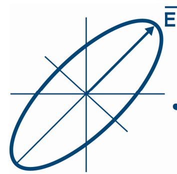

J.A. Woollam Co., Inc.

Ellipsometry Solutions

RC2 SPECIFICATIONS (6/4/2013)

Optical Configuration (along the light path)

Double-Rotating Compensator Ellipsometer:

- Source – Polarizer – Rotating Compensator – Sample – Rotating Compensator – Polarizer – Spectrometer

Spectral Range

Model X: 210nm to 1000nm, 790 wavelengths
Model D: 190nm to 1000nm, 800 wavelengths
NIR extension: 1000nm to 1690nm, 275 wavelengths

Spectral (Pixel) Resolution/Bandwidth

Model X, D: 1 nm wavelength spacing, 3nm bandwidth
NIR extension: 2.5 nm wavelength spacing, 5nm bandwidth

Data Acquisition Rate

Complete acquisition cycle for SE or full MM data is 0.3 seconds.
For best signal-to-noise, measurements are averaged from 2-10 seconds at each angle.

Beam Divergence

Less than 0.4°

Beam Diameter

Standard beam is collimated with 3-4mm diameter.
With Focusing, two options are available:

- 40mm focal length lens:
  Beam diameter (short direction) is less than 300 microns.
  Maximum Angle of incidence is 75°
- 27mm focal length lens:
  Beam diameter (short direction) is less than 200 microns.
  Maximum Angle of incidence is 65°

Components

Light Source:
  Model X: 150W Xenon lamp
  Model D: Combined Deuterium/Quartz-Tungsten Halogen lamps
Compensators:
  Patented achromatic design
Detector:
  To 1000nm: 1024 pixel silicon CCD
  1000-1690nm: 256 pixel InGaAs Array

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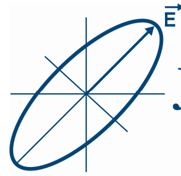

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Measurement Quantities

Spectroscopic Ellipsometry:
- Ψ (0-90°) and Δ (0-360°)
- N,C, and S

Intensity:
- %Transmission and %Reflection

Depolarization: %Depolarization

Generalized Ellipsometry*:
- AnE, Asp, and Aps (3 ratios of generalized Jones matrix)

Mueller Matrix*:
- All 15 normalized elements of the Mueller-matrix (normalized to m11).

**Useful for measuring and characterizing anisotropic materials with cross-polarization.*

Straight-Through Accuracy

(10 second measurement of empty-beam, met by 95% of all wavelengths)

Psi: 45° ± 0.02°
Delta: 0° ± 0.05°
Depolarization: 0% ± 0.5%
15 normalized Mueller-Matrix elements:
- Diagonal: 1 ± 0.002
- Off-Diagonal: 0 ± 0.002

Off-Sample Data Fit Accuracy

(10 second measurement of nominally 25nm SiO_2/Si)

MSE defined in terms of N,C,S < 0.002
MSE defined in terms of Mueller-matrix elements < 0.002

Thickness Precision:

(30 consecutive (static) 10-second measurements of nominally 25nm SiO_2/Si)

Standard deviation in thickness < 0.005 nm

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