alpha 2.0

J.A. Woollam

Ellipsometry Solutions

Overview

The alpha 2.0 is a budget-friendly option for routine measurements of thin film thickness and refractive index.

A compact footprint and simple design make the alpha 2.0 easy to use while harnessing the power of spectroscopic ellipsometry. It was designed for ease-of-use: simply place the sample on the stage, choose the model that matches your film, click “measure”, and you will have results within seconds.

Why alpha 2.0

+Easy-to-Use

Push-button operation is complemented by advanced software that takes care of the work for you.

+Powerful

Proven spectroscopic ellipsometer technology gives you both thickness and refractive index with much higher certainty than other techniques.

+Flexible

It works with your materials – dielectrics, semiconductors, organics, and more.

+Affordable

A streamlined instrument created for research and development of simple samples.

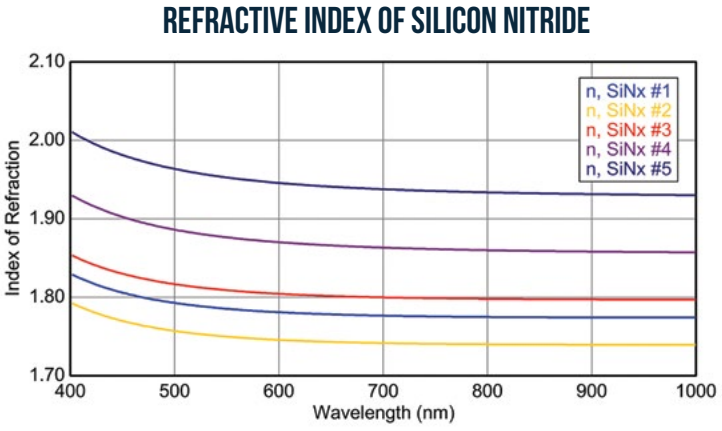
+Fast

Simultaneous collection of 190 wavelengths for high-speed, multi-angle ellipsometry measurements.

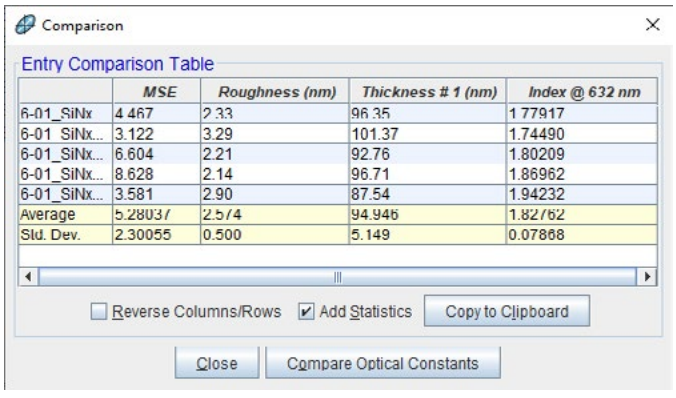
Applications

Transparent Films

With fast measurement speeds and push-button operation, the alpha 2.0 is ideal for qualifying transparent thin films. Single-layer dielectrics on silicon or glass substrates can be measured in seconds. Log results for easy-to-use comparisons in both graphical and tabular formats.



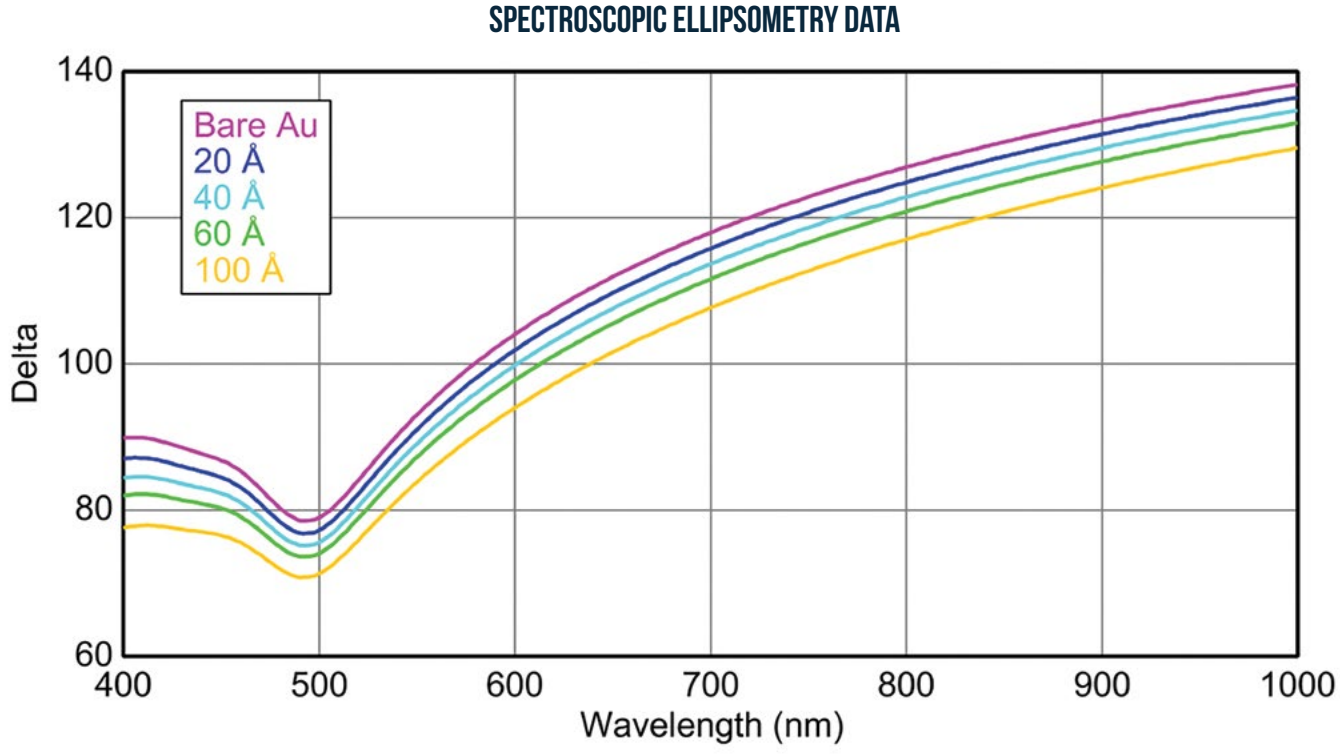
A series of silicon nitride thin films is quickly compared to study variation in the thickness and refractive index with process conditions.



Results can be easily compared in tabular form using our comparison tools.

Self-Assembled Monolayers

Phase information of a spectroscopic ellipsometry measurement is highly sensitive to very thin films (<10 nm). For example, self-assembled monolayers can be measured and quickly compared using the alpha 2.0.



For thin organic layers on gold, the phase parameter (Δ) shifts downward with increasing thickness.

Applications (Continued)

Absorbing Films

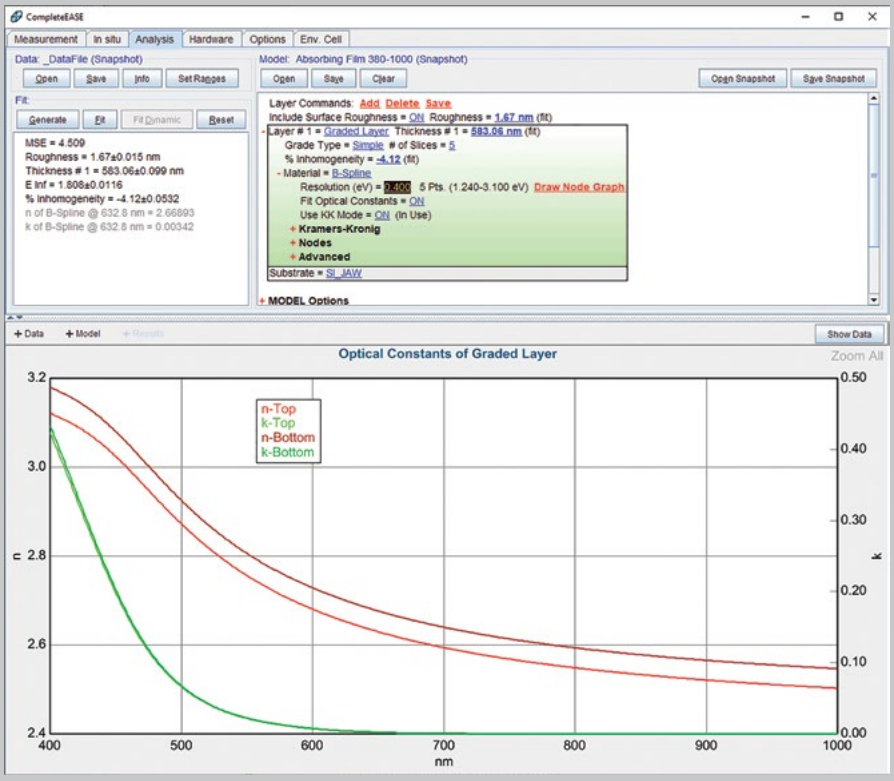
Advanced models allow quick and efficient fits for a wide variety of absorbing materials.

Materials

+a-Si
+poly-Si
+Diamond-like carbon
+Organic materials
+Organic LED films
+SiC
+Photoresist
+Display color filters
+Metals

Models

+Lorentz
+Gaussian
+Drude
+Tauc-Lorentz
+B-Spline



Coatings on Glass

Patented technology allows accurate measurements on any substrate: metal, semiconductor, or glass. For transparent substrates, the alpha 2.0 simultaneously measures depolarization to correct for light returning from the backside of the substrate. This unwanted light can confuse other ellipsometers, but the alpha 2.0 ensures accurate thickness and optical constants.

Analysis Results

Copy Table to Clipboard

Parameter	Ideal	Roughness	Grading	Roughness & Grading	Anisotropy
MSE	22.126	20.725	5.088	3.471	22.124
Roughness	*N/A*	2.71 ± 0.571 nm	*N/A*	1.29 ± 0.093 nm	*N/A*
A	2.236 ± 0.005161	2.237 ± 0.004834	2.241 ± 0.001185	2.241 ± 0.00080736	2.234 ± 0.006353
B	0.04182 ± 0.006875	0.03910 ± 0.006455	0.03341 ± 0.001532	0.03236 ± 0.001048	0.04242 ± 0.007873
C	0.00190 ± 0.002673	0.00322 ± 0.002516	0.00700 ± 0.00060069	0.00747 ± 0.00041129	0.00180 ± 0.002736
% Inhomogeneity	*N/A*	*N/A*	13.70 ± 0.252	13.20 ± 0.176	*N/A*
Thickness # 1	766.26 ± 1.380 nm	766.68 ± 1.295 nm	766.12 ± 0.324 nm	766.45 ± 0.222 nm	767.32 ± 2.008 nm
n of Cauchy Film @ 632.8 nm	2.35236	2.35450	2.36787	2.36805	*N/A*

<< Apply Chosen Model >>

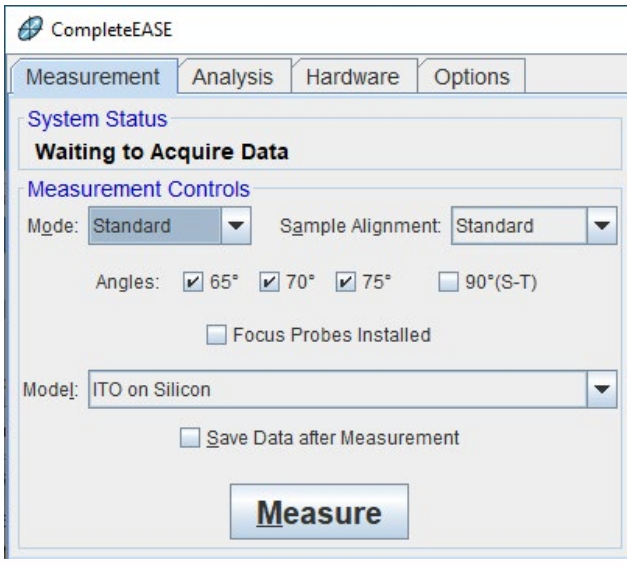
Show Graphs

The high sensitivity of alpha 2.0 technology provides microstructural details that you cannot get from reflectance measurements. A thin film of Titanium Dioxide is measured with the alpha 2.0, and its index is found to vary between the substrate and surface. A graded model with rough surface best describes this sample.

Easy Measurements

The alpha 2.0 was designed for ease of use and does not require extensive experience with ellipsometry to get the most out of the instrument. The instrument operates on our powerful CompleteEASE software to enable analysis of even the most complex samples. Measurement results can be achieved in just a few steps.

Three Simple Steps:



1. Mount your sample and choose your measurement settings:

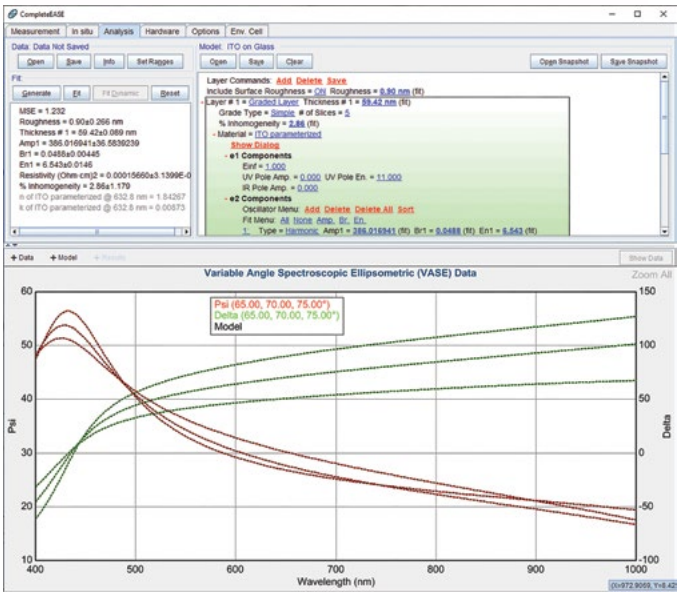
+Angles
+Sample alignment
+Model (optional)

Setting up a measurement is easy. Select the preferred angles and alignment procedure. If a model has already been developed, it can be selected at this time as well.

2. Click 'Measure':

+Align
+Measure
+Analyze

The sample is automatically aligned and measured. If a model was selected, the data will be automatically analyzed and results will be displayed immediately following the measurement.



3. Review Your Results:

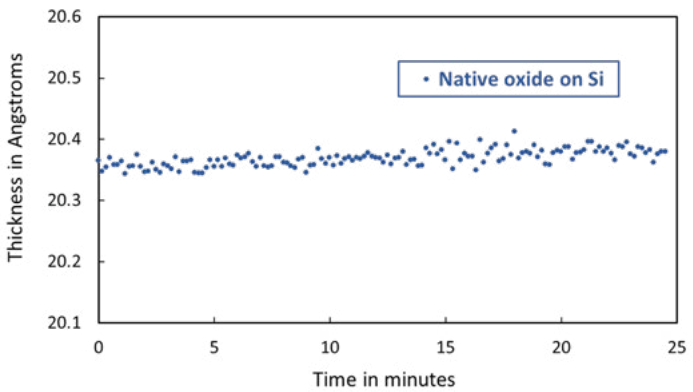
+Film thickness
+Refractive index
+Derived parameters

The results shown are determined by the model. The most commonly reported parameters are film thickness and refractive index. Ellipsometry is also sensitive to surface conditions, anisotropy, crystallinity, and more. Related parameters are reported if included in the model.

Thickness & Refractive Index

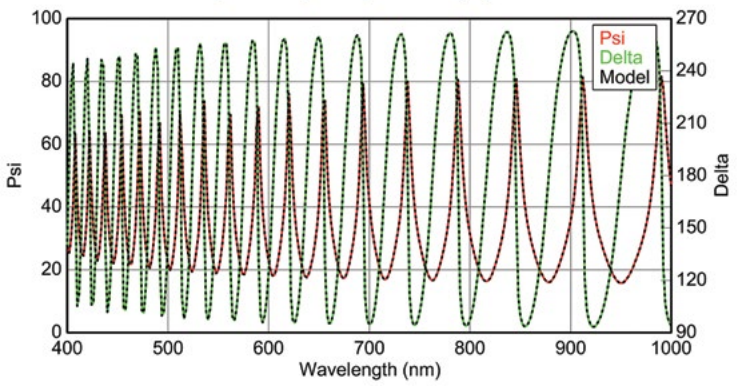
Spectroscopic ellipsometry is perfect for characterizing thin film thickness and refractive index. The alpha 2.0 can measure film thicknesses ranging from ultra-thin monolayers to several microns.

NATIVE OXIDE ON SILICON



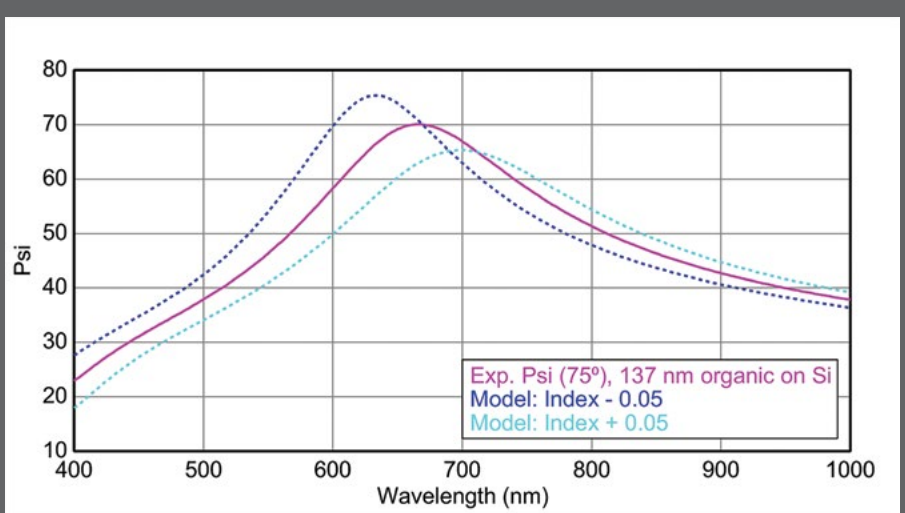
Dynamic measurements of a native oxide on silicon show very stable, sub-angstrom precision.

5-MICRON-THICK OXIDE

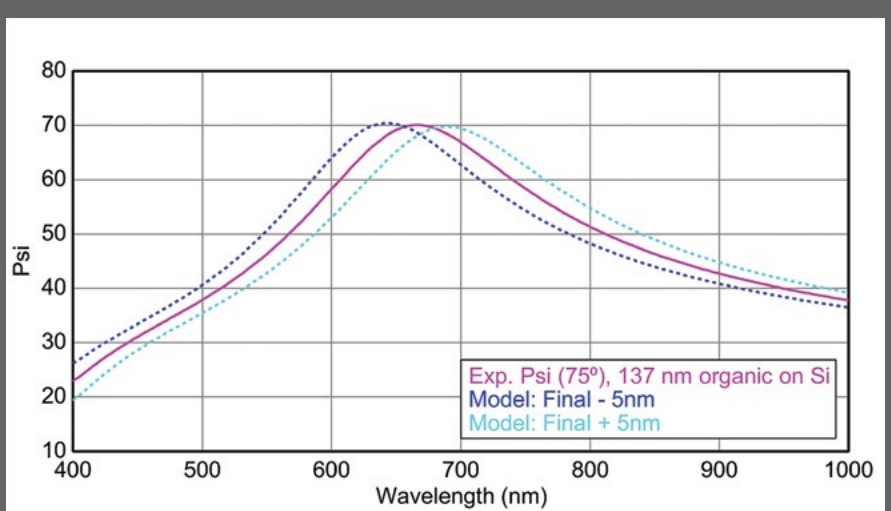


This 5-micron-thick oxide has a large number of interference features that are well-resolved by the alpha 2.0.

VARIED INDEX



VARIED THICKNESS



An organic layer on silicon is easily characterized by the alpha 2.0 to determine thickness and refractive index. Simulated values with varied thickness and varied index (see graphs to the left) show the distinct changes that give ellipsometry unique results for both film properties.

Specifications

Spectral Range

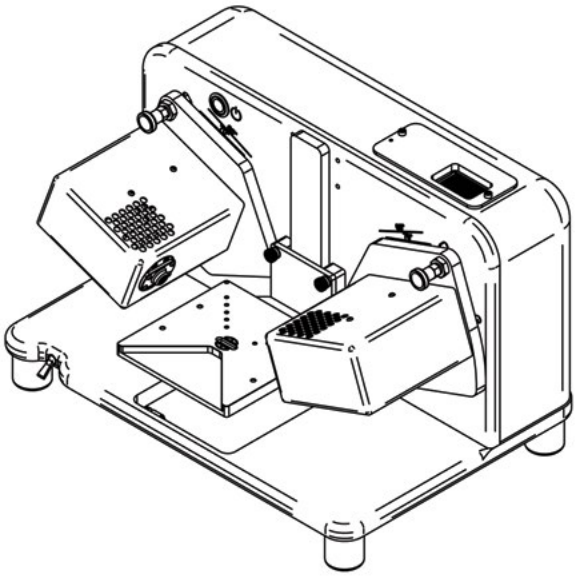
400 nm to 1000 nm, 190 wavelengths

Angle of Incidence

- Manual adjustment
- 65°, 70°, 75°, or 90° (straight-through)

System Overview

- Dual-Rotation optical design
- CCD detection
- Automated sample alignment



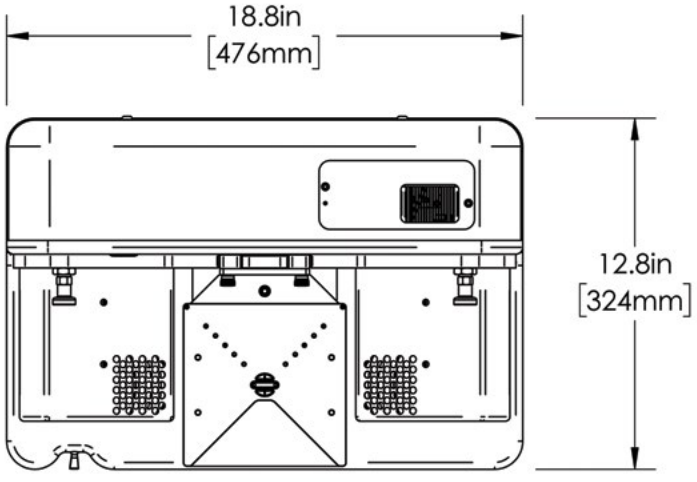
alpha 2.0 3D View

Sample Size

The alpha 2.0 accommodates samples up to 200-mm diameter and 16-mm thick.

Data Acquisition Rate

- 5-10 seconds for full spectrum [typical]



Top View

Software

CompleteEASE for data acquisition, data analysis, and optical simulations

Beam Diameter

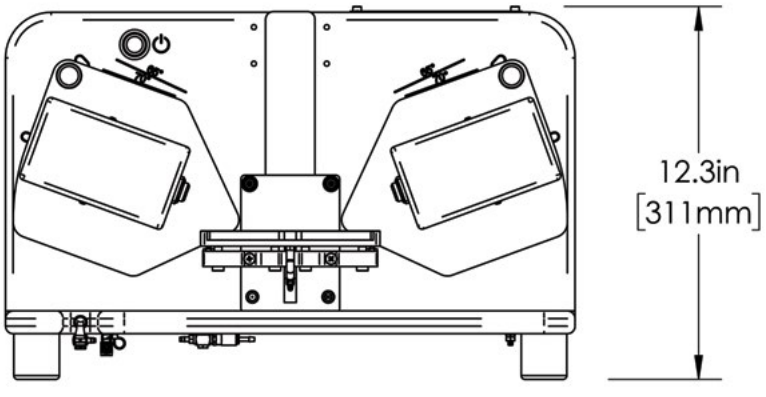
- Focused: < 1 mm

Power Requirements

100/240 VAC, 47-63 Hz, < 1 Amp

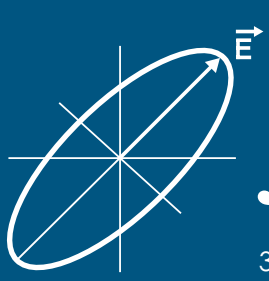
Light Source

Quartz Tungsten Halogen (QTH)



Front View

For more information:



J.A. Woollam

311 South 7th Street | Lincoln, NE 68508 | USA