Ocean Optics

# SpecEl-2000

## Spectroscopic Ellipsometry

### A convenient system

The SpecEl-2000 is a user-friendly, bench-top thin film measurement system utilizing Spectroscopic Ellipsometry. Ideal for flat, multi-layer, semi-transparent samples such as wafers or glass plates. The Spec-El-2000 is designed to be affordable, compact and convenient, with easy placement of the sample and one button operation.

*The SpecEl is the ideal measurement tool for flat, multi-layered, semi-transparant samples*

### Features

- film thickness accuracy 1 nm, resolution down to 0.1 nm
- measures multi-layer stacks up to 25 layers
- single film thickness from 0.1 nm up to 10 µm
- spectral ranges 400 to 1000 nm
- standard spot size 0.3 mm x 1.2 mm
- ideal for flat, semi-transparent samples such as wafers, glass, films and foils
- 2D mapping, reference wafers, accessories and other options available - custom solutions on request
- accompanying software allows generation and recall of measurement recipes for one-step, repetitive measurements

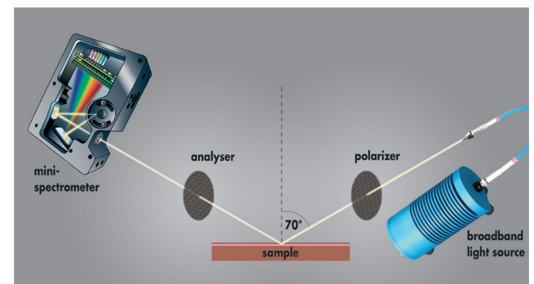
### Optical characterization

Ellipsometry is a preferred method for characterizing thin films – relying on two aspects of the interaction of light with dielectric materials - firstly, that the polarization of light is altered upon reflection from a surface, and secondly that the transmission of light through a transparent layer changes the phase according to the refractive index of the material.

For all layers in a transparent thin film stack, light reflects and refracts at each interface. Multiple beams result with varying polarization and phase, all of which interfere. Ellipsometry is used to characterize film thickness ranging from a few tenths of a nanometer to several micrometers with excellent accuracy.

### Measurement technique

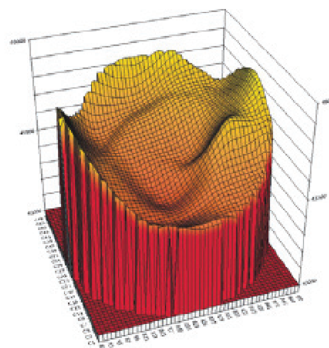
Spectroscopic ellipsometry is a vastly more powerful technique than single wavelength (laser) ellipsometry. Here, a broadband light source covering a certain range in the visible and infrared spectral regions is used to illuminate a small area on the sample. By analyzing the reflected beam at 1nm intervals over a wide spectral region, much more detail on the material system can be determined. Versatility and sensitivity are greatly enhanced and characterization can be extended to multi-layer systems exhibiting considerable complexity.




*Schematic of the measurement set-up for Spectroscopic Ellipsometry*

## The system

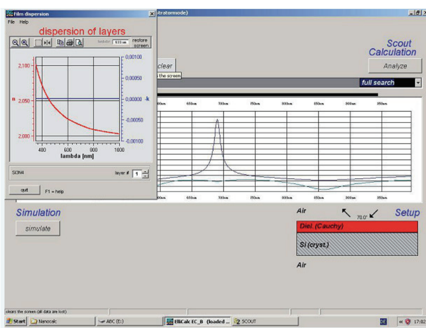
The SpecEl-2000 system comes with a 32-bit Windows PC as standard, complete with powerful software offering a range of modelling possibilities such as Cauchy, OJL, Tauc-Lorentz, Drude, EMA and different types of oscillators. The software also stores specific measurement routines, reducing the tedium of repetitive measurements and easing integration. System options include reference wafers and 2D mapping accessories, with custom, multi-functional solutions.



*Mapping options for the SpecEl-2000 allow high resolution 2D scans of film thickness*

## Components

Half the price of standard ellipsometry equipment, the Spec-El-2000 features an integrated broadband light source, guiding optics, a rotatable polarizer, the sample table, a second rotating polarizer (analyzer), further optics and finally a miniaturized spectrometer with a CCD array as a detector. The angle of incidence is nominally set to 70°, but can be customer specified to any angle between 65° and 75°. The desktop foot-print is extremely small (52cm x 33cm x 24cm).




## Specifications Spec-EL

| **PERFORMANCE** | |
|---|---|
| Thickness | 1 nm - 8 µm |
| Resolution | 0.1 nm |
| n & k analyzer | values calculated for complete spectral range |
| Mathematical models | Constant refractive index, harmonic oscillator, Cauchy, Sellmeier, dielectric, KKR Drude, imported dielectric functions, Brendel, Kim, OJL interband transition model, Tauc-Lorentz, Campi-Coriasso, heterogeneous materials (multi-phase composites), effective medium concepts for inhomogeneous materials, Maxwell-Garnett, Bruggemann, Looyenga formula, Bergman representation and more ... |
| Measurement speed | 7 - 13 seconds |
| Repeatability | 70nm for SiO2 on Si, cos(Delta) ±0.0003, tan(Psi) ±0.0002 |
| **OPTICAL** | |
| Spectral range | 400 - 1000nm VIS/NIR |
| Spectral resolution | 1 nm |
| Beamer diameter | 300 µm x 1200 µm (smaller spots available on request) |
| Angle | 70° (other angles on request) |
| **MECHANICAL TOLERANCE (for sample adjustment)** | |
| Height adjustment | ± 1 mm |
| Angle adjustment | ± 1° tilt |
| **COMPUTER** | |
| Software | WindowsXP™ software included, recipe structure, administrator/user compatible |
| Hardware | IBM compatible PC with WindowsXP™ OS included |

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