

SE 400adv Multiple Angle Laser Ellipsometer

Product description



- Contactless, optical measurement of thin film thickness, refractive index, absorption and degree of polarization as an indicator of sample non-idealities
- Extraordinary high stability and accuracy due to stable laser light source, temperature stabilized compensator setup, polarizer tracking and ultra-low noise detector
- Highly precise sample alignment with optical auto collimating telescope and microscope
- Modern, comfortable, streamlined and robust user interface includes a comprehensive package of predefined applications representing microelectronics, magnetic media, life science and more
- Fast and comfortable measurement at a selectable, application specific single angle of incidence
- Fully integrated support of multiple angle measurements for more complex applications and absolute thickness
- Unique, affordable combination of laser ellipsometer with optional spectrophotometer provides dispersion $n(\lambda)$ and absolute thickness

1 General description

The multiple angle laser ellipsometer **SE 400adv** provides the film thickness and optical constants at the HeNe laser wavelength 632,8 nm with an extraordinary precision and accuracy. The SE400advanced can be utilized to characterize single films, multiple layer stacks and bulk materials (substrates). The function of the **SE 400adv** is based on ellipsometry as a non-contact, optical reflection measurement technique with polarized laser light.

Due to its modern, easy to use, recipe oriented and robust software the **SE 400adv** fits the requirements of R&D as well as of quality control in production environments. It covers a large variety of applications like microelectronics, III-V semiconductors, biology and life science, display technology, magnetic media, metal processing and much more. High sensitivity over the entire (Ψ , Δ) plane and ultra-low noise detection allow for measuring even non-ideal, stray light causing, rough surfaces as e.g. solar cells.

The **SE 400adv** is designed to tap the full potential of the method ellipsometry and to push the limits. The core concept of the **SE 400adv** with highly phase stabilized compensator, computer controlled frequency stabilized rotating analyzer and automated polarizer optimum positioning allows for the measurement of ultra-thin films and surface roughness on almost any kind of absorbing or transparent substrate with a flat, mirror - like surface.

The **SE 400adv** comprises a manual goniometer with superior performance and angle accuracy to perform fast variable angle measurements for more complex samples.

The **SE 400adv** is a compact instrument, quickly up and running. Controlled by any state of the art PC or notebook computer via Ethernet LAN it is prepared to keep up with the frequent changes in PC and operating system technology.



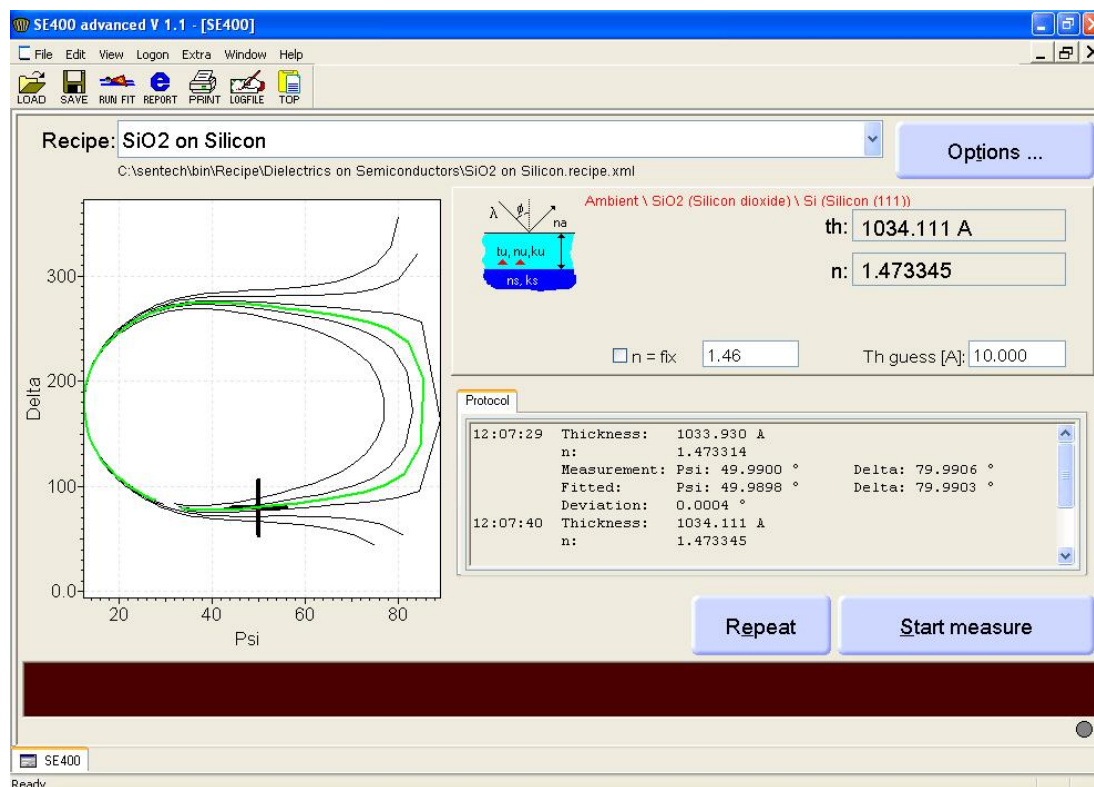
SE 400adv standard instrument with laptop (left picture) and controller (right picture).

2 SE 400adv Software Features

The necessary measurement and analysis operation sequence is optimized with regard to minimal clicks and maximum robustness. Predefined applications (recipes) allow for ease of use. Adding or editing a recipe is quite easy because one can take advantage of the large implemented material database.

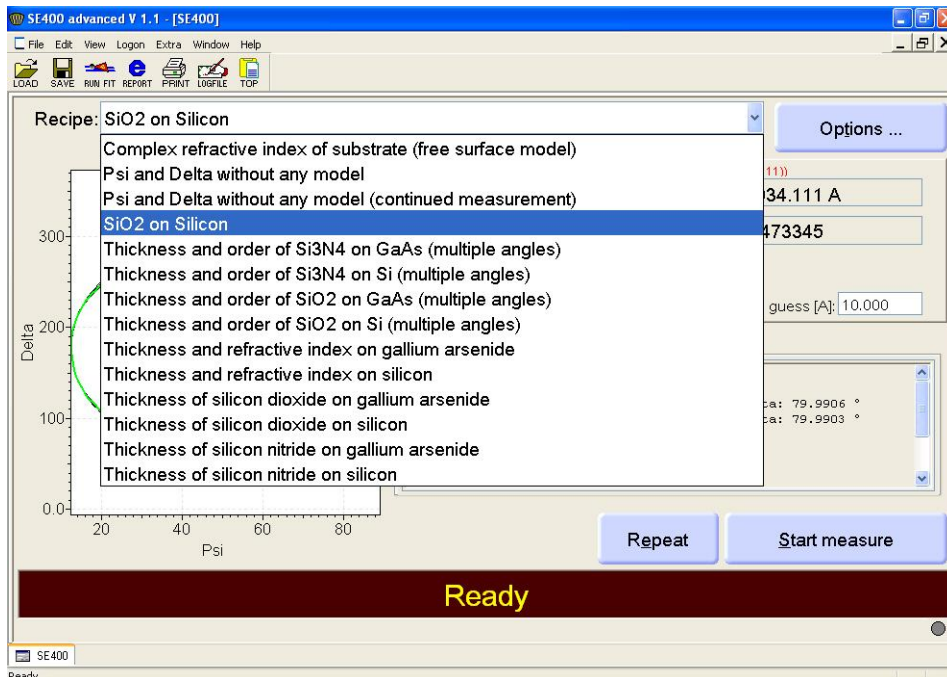
The **SE 400adv** software supports localization, i.e. it supports different languages: English (Default), German. Other languages with Cyrillic or Asian character sets can be supported as well and are available on request.

The **SE 400adv** user interface comprises a graphical feedback of Goodness of Fit as a quick indicator whether your sample properties are as expected.

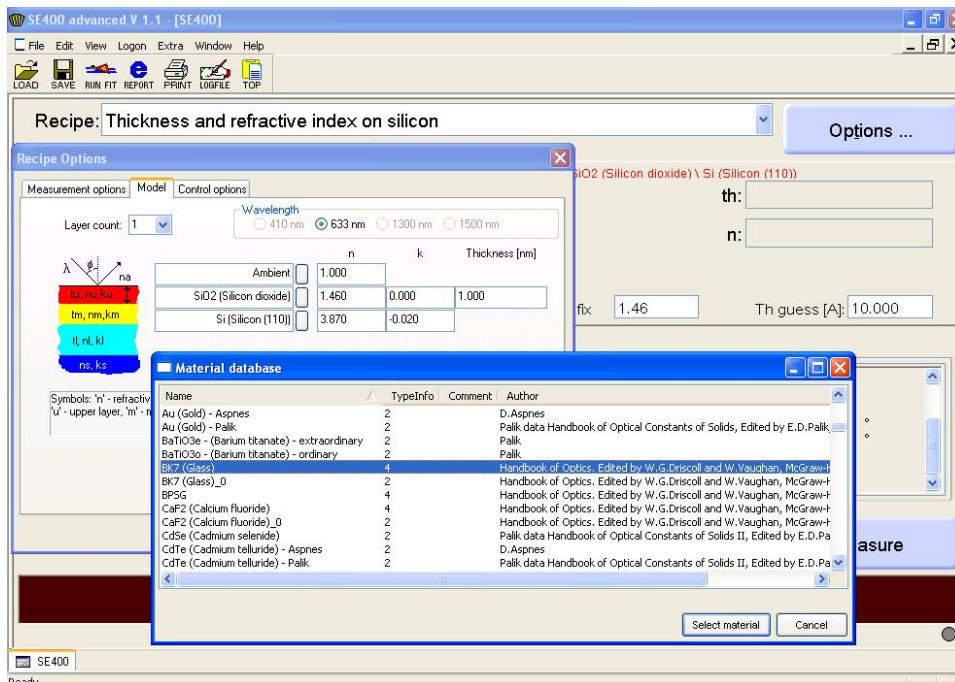


Screenshot of the user interface of the **SE 400adv** software

The results (film thickness and refractive index) are displayed as numbers in the boxes at the top right position. The protocol window shows the logging of the last measurements. The graphical display provides an optical feedback for the goodness of fit. A good match of the measured data (symbolized as cross hair) with the automatically generated theory curve is an indication of consistency and provides confidence for the measured values.



Selection of a predefined application (recipe) prior to the measurement. Recipes can easily be added or edited.



Buildup of a new model using the material library

Creating or editing a recipe is quite easy because one can take advantage of the large implemented material database. By picking a material by its name one can change the optical constants of the substrate, ambient or layers. Comparing your own results with the expected optical constants improves your ability to evaluate the sample.

3 Technical Specifications

Wavelength:	632.8 nm HeNe laser (Class 1 device)
Precision ¹⁾ of ψ, Δ at 90° (transmission) position:	$\delta(\psi)=0.002^\circ$ $\delta(\Delta)=0.002^\circ$
Long term stability ²⁾ :	$\delta(\psi) = \pm 0.01^\circ$ $\delta(\Delta) = \pm 0.1^\circ$
precision ¹⁾ of film thickness:	0.1 Å for 100 nm SiO ₂ on Si
precision ¹⁾ of refractive index:	5×10^{-4} for 100 nm SiO ₂ on Si
total thickness range for transparent layers:	up to 6 µm
total thickness range for weakly absorbing layers (polysilicon):	up to 2 µm
Number of layers	Default: 1-3 layers on a layer stack or substrate
measurement time:	120 ms 1.5 s (depending on measuring mode)
Setup	PCSA with Compensator highly stabilized Compensator C, superior precision for Δ near 0° and 180° computer controlled Polarizer P for optimum positioning/ tracking and self- calibrating capability highly stable rotating Analyzer A
diameter of laser beam:	1 mm
angle of incidence:	manual goniometer 40° - 90°, set in steps of 5°
sample alignment:	auto collimating telescope (ACT) for manual sample tilt and height adjustment, optional: auto focus
sample stage:	fixed (z, tilt) sample stage for wafers up to 150 mm diameter <u>Options:</u> - 360° rotation unit, - vacuum chuck - x-y mapping stages 50 mm x 50 mm, motorized 150 mm x 150 mm manual or motorized 200 mm x 200 mm motorized
set-up and service:	automatic calibration of the ellipsometer, service mode including self-test
maintenance:	automatic internal maintenance programs for checking the correct working of most parts of the ellipsometer
PC, monitor	state of the art PC with mouse, keyboard, monitor, LAN, MS Windows 7 operating system, TFT flat screen monitor

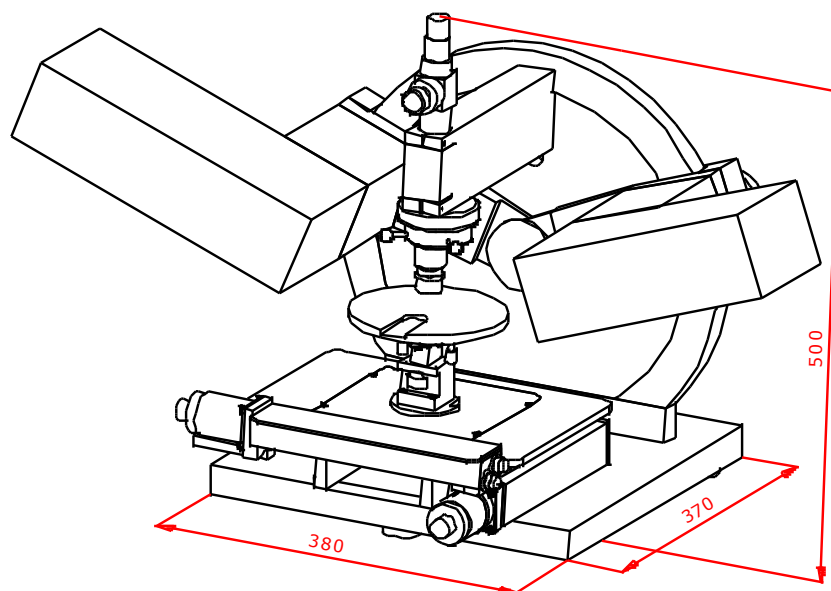
software:	<p>SENTECH's user friendly SE400advanced ellipsometer software; Predefined applications (recipes) allow for ease of use: e.g.</p> <ul style="list-style-type: none"> - dielectric layers on Si - dielectric layers on GaAs - organic layers on Glass - native oxide on Si - native oxide on GaAs <p><u>Standard Measurement Modes</u> <i>Single angle of incidence</i> (at any single angle between 40 and 85 degrees, 5 deg step) ψ, Δ on any sample optical constants of bulk material (substrate) n_s, k_s single films, film thickness at a given refractive index n single films, film thickness and refractive index n double layer, two thicknesses, film thickness 1 and film thickness 2</p> <p><i>Multiple angles of incidence</i> (any set of angles out of 40-85 deg, 5 deg step) any layer of single or out of multiple layer: absolute film thickness at a given refractive index n any layer of single or out of multiple layer: film thickness, refractive index n any layer of single or out of multiple layer: film Thickness, refractive index n and absorption k</p> <p>Material library includes: Dielectrics, weakly absorbing films, crystalline and amorphous Semiconductors, Metals, Organics (polymers, resists), Glass, Quartz and more</p>
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Notes

¹⁾ precision is defined as standard deviation (1 sigma) of 30 measurements

²⁾ long term stability is measured over 24 hours at 90° position

4 Dimensions: (with 150 mm xy mapping option)



5 Further Options:

SE 400-1	Micro spots
SE 403	SIMULATION software
SE PSV	Vacuum chuck in lieu with standard sample stage
SE PSD	Rotational element with quick lock
SE PXY	Manual x-y stage with 50 mm travel
SE 14	Motorized mapping stage (50 mm sample diameter)
SE 15	Motorized mapping stage (150 mm sample diameter)
SE 16	Motorized mapping stage (200 mm sample diameter)
SE 20	Liquid cell
SE AF	Auto focus option in combination with mapping option
SE 61	Camera option in lieu of the ACT
SpectraRay/L	SpectraRay for simulation of complex samples and evaluation of multiple angle of incidence measurements for SE 400adv laser ellipsometer