Raising Thin Film Metrology Performance To A New Level



FilmTek™ Spectrophotometry-Based Metrology Systems

10 to 100 Times Better Resolution

FilmTek™ spectrophotometry-based metrology systems from Scientific Computing International (SCI) have long set the standards for characterization of thin films.

Our FilmTek™ 4000 Series "raises the bar" by delivering 100 times the resolution of the best non-contact method, and 10 times the resolution of the best prism coupler contact systems.

It's the result of our patented DPSD™ (Differential Power Spectral Density) technique. And it's the latest example of how SCI is leading the thin film metrology field by raising performance to a new level while offering systems that are truly affordable for virtually every application.



Widest Film Thickness, Layer & Spectral Ranges

FilmTek™ systems provide peak performance from very-thin to very-thick films (up to 350 microns). It's achieved by high wavelength resolution detectors combined with low cone angle optical design and apertures to limit measurement spot size. Depending on the films involved, FilmTek™ systems can characterize multiple layers simultaneously. And they all offer a wavelength measurement range from 190 to 1700nm using our proprietary dispersion model.

Easy-to-Use Computer Power

Our complete, turn-key systems are designed for simple, efficient, trouble-free push button operation. The powerful software was designed to put measurements and answers just a click away. And to help characterize and control deposition processes, it includes such capabilities as 2D and 3D contour and surface graphic plotting, a customizable database interface, and the ability to be controlled by a host computer.

Versatile, Flexible, Reliable

Standard and custom FilmTek™ systems are available in a variety of configurations — from manual table top models, to fully automated systems with robotic cassette transfer and pattern recognition. All are designed for optimum accuracy and repeatability. They're easy to calibrate and operate. And, with features like our unique optical design with no moving parts, they deliver long-lasting, reliable, trouble-free performance.



Affordable Systems for Virtually Every Budget

A variety of configurations are offered in the standard FilmTek™ family. SCI also develops customized models including options such as automated XY stages with robotics for wafer mapping and handling to meet special needs. And they're all priced to fit most budgets.

- **FilmTek™ 1000** is the most affordable system for measuring reflection at normal incidence in the visible to NIR. **FilmTek™ 1500** adds transmission mode measurements.
- **FilmTek™ 2000** augments those capabilities to encompass surface roughness and reflection at normal incidence from deep UV to NIR. Options include optics for small spot size measurements based on a microscope design (FilmTek™ 2000M) or parabolic mirrors (FilmTek™ 2000 PAR).
- **FilmTek™ 3000** measures transmission and reflection of films deposited on transparent substrates. It's ideally suited for measuring the thickness and optical constants of very thin absorbing films.
- **FilmTek™ 2000SE** is an affordable spectroscopic ellipsometer that measures from the deep UV to NIR (190-1700nm). Based on a rotating compensator design, the FilmTek™ 2000SE spectroscopic ellipsometer combines spectroscopic ellipsometry with normal incidence reflectometry to make it ideally suited for measuring the thickness and optical constants of very thin films. The FilmTek™ 3000SE spectroscopic ellipsometer adds transmission measurement capability in addition to spectroscopic ellipsometry and reflectometry.

- **FilmTek™ 4000** incorporates multiple detectors positioned at different angles of incidence — plus our patented multiangle Differential Power Spectral Density analysis capability — to accurately measure the index of refraction with a resolution of 0.00002. That's 100 times the performance of the best non-contact method, 10 times that of the best prism coupler contact systems.

The FilmTek™ 4000 can measure birefringence of anisotropic materials. With its hot plate option, it can characterize the index of refraction and thermal expansion of a film as a function of temperature. And its spectroscopic ellipsometer option allows measurement of very thin films. A prime application for this system is measuring the index of refraction and thickness of planar waveguide films.

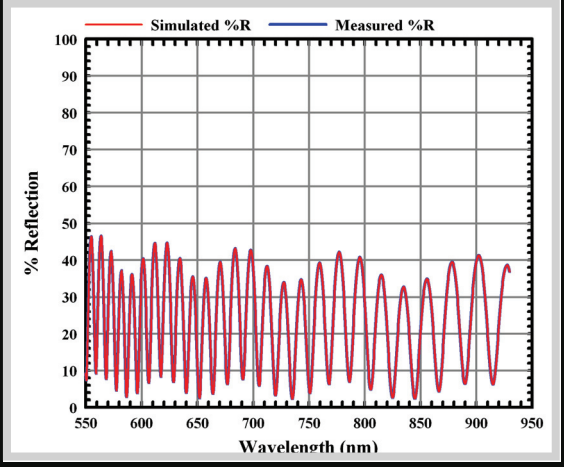
Standard FilmTek™ Measurement Features

Measurement Features	FilmTek™ 1000/1500	FilmTek™ 2000/3000	FilmTek™ 2000/3000 SE	FilmTek™ 4000/4500
Index of Refraction (at 2µm thickness)	±0.005	±0.002	±0.0002	±0.00002
Thickness Measurement Range	10nm-200µm	5nm - 200µm	1Å –200µm	3nm - 200µm
Maximum Spectral Range (nm)	380 -1000	190 -1700	190 -1700	190 -1700
Standard Spectral Range (nm)	380 -1000	240 - 1000	240 - 1000	380 -1000
Reflection	✓	✓	✓	✓
Transmission	✓ **(1500)**	✓ **(3000)**	✓ **(3000)**	✓ **(4500)**
Spectroscopic Ellipsometry			✓	
Power Spectral Density	✓	✓	✓	✓
Multiangle Measurements (DPSD)			✓	✓
TE and TM Components of Index				✓
Multi-layer Thickness	✓	✓	✓	✓
Index of Refraction	✓	✓	✓	✓
Extinction (absorption) Coefficient	✓	✓	✓	✓
Energy Band Gap		✓	✓	✓
Composition		✓	✓	✓
Crystallinity		✓	✓	✓
Inhomogeneous Layers		✓	✓	✓
Surface Roughness		✓	✓	✓

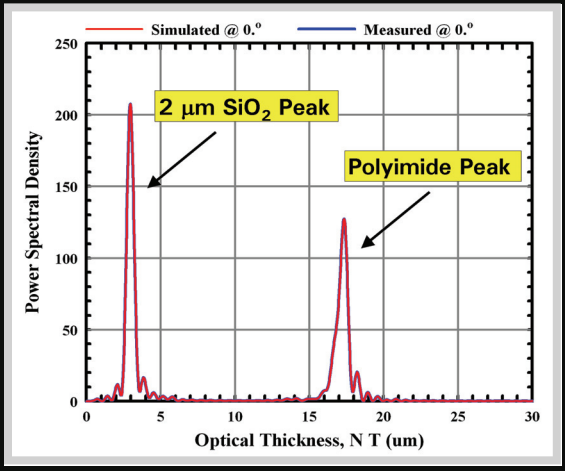
A variety of options can extend these standard measurement capabilities.
Specifications are subject to change without notice.

Reflectance & Power Spectral Density Analyses

Analysis of polyimide film coating a thermal oxide film grown on a silicon wafer.

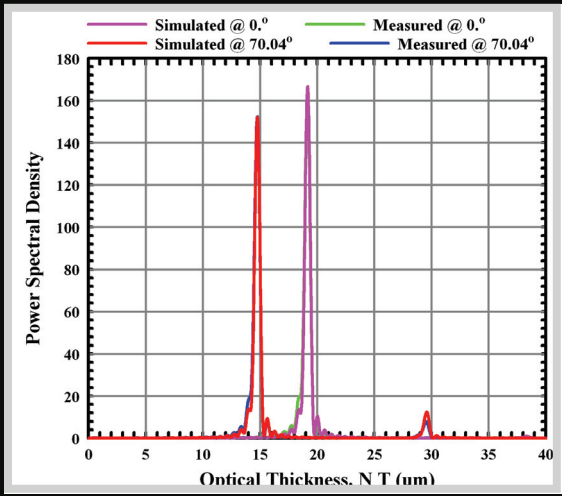


Power Spectral Density analysis of polyimide and oxide films.



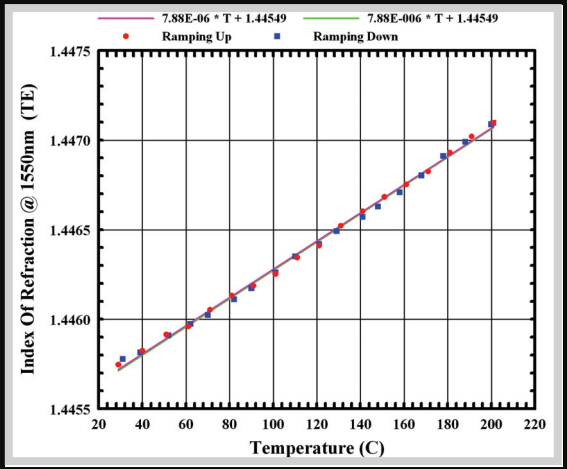
FilmTek 4000 High Precision Measurement of Index

This unique FilmTek™ 4000 capability employ's our patented DPSD (Differential Power Spectral Density) technique. Spectroscopic reflection data are gathered at normal incidence and 70 degrees. PSD processing results in two peaks in the Power Spectral Density domain. The ratio of their positions is a function of the index of refraction of the film, and the angle of incidence of the oblique measurement. This ratio is used to calculate the index. Once the index is known, the thickness can be calculated from the optical thickness of the normal incident peak.

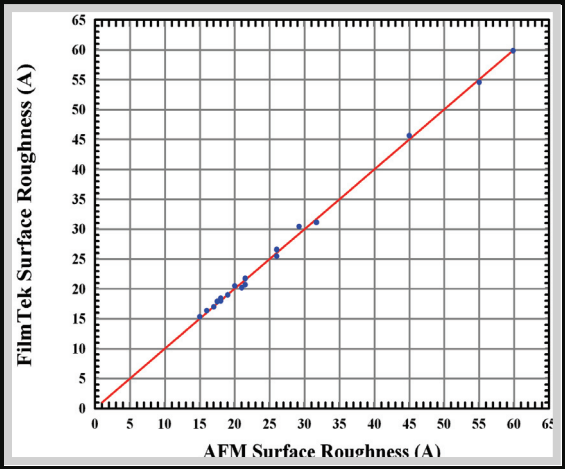


SiO_2 Film Properties vs Temperature

Measured by FilmTek 4000 with heating chuck during one heat-cool cycle

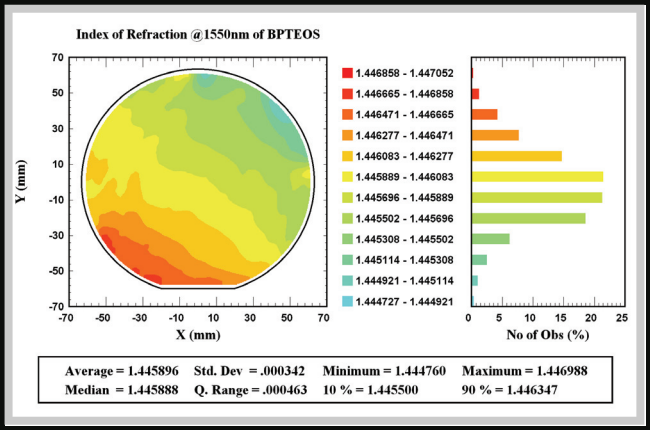


FilmTek vs AFM Surface Roughness Measurement



FilmTek Mapping Capabilities

Index Map @ 1550nm of BPTEOS using automated stage



SCI Dispersion Model

Our dispersion model is derived from quantum mechanical principles and correctly obeys the Kramer-Kronig relationship. It is applicable to metallic, semiconductor, amorphous, crystalline, and dialectic materials. A broad array of single layer and multilayer films have been successfully analyzed, including:

- SiN_x
- SiO_xN_x
- PSG
- BPSG
- ITO
- a-Si
- Polysilicon
- a-c:H
- DLC
- Low K Dielectrics
- Photoresist
- Polyimide
- SOG
- Films used in manufacturing thin film heads

Substrate examples include:

- Silicon
- SOI
- SOS
- GaAs
- Glass
- Aluminum

By employing a dispersion model covering the entire wavelength range of the measurement, the number of variables or parameters required to model optical response is reduced, eliminating the potential for multiple solutions.

FilmTek Configurations

We offer a variety of configurations and options to fit every need from R&D to high volume manufacturing in controlled environments. They include:

- Standard probe head (2mm spot size)
- Microscope based (down to 5µm spot size)
- Reflection mode measurements
- Transmission mode measurements
- Spectroscopic ellipsometry measurements
- Automated stage
- Cassette to cassette robotic transfer
- SMIF box
- Pattern recognition
- Heating chuck
- In-situ; for integration with process equipment
- Windows based operating system
- Menu-driven, user friendly software

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