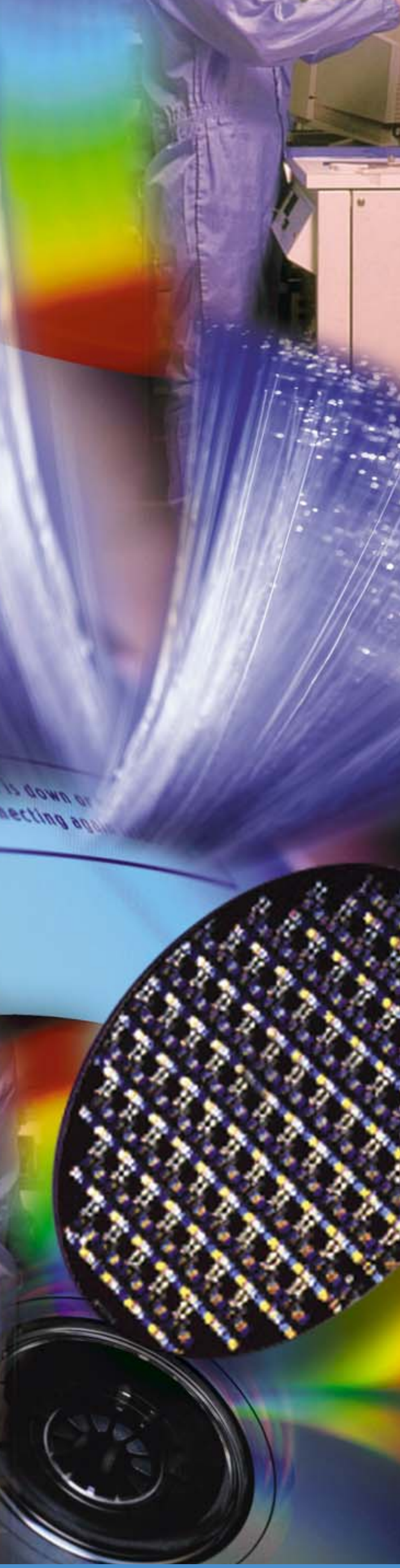
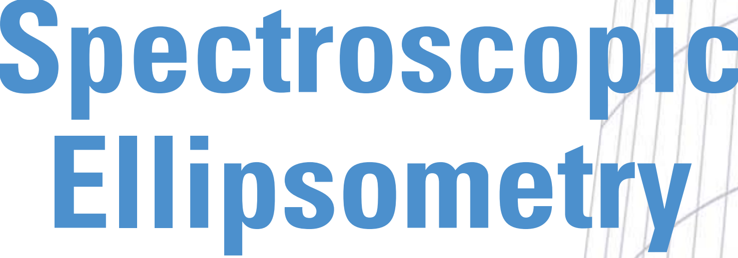
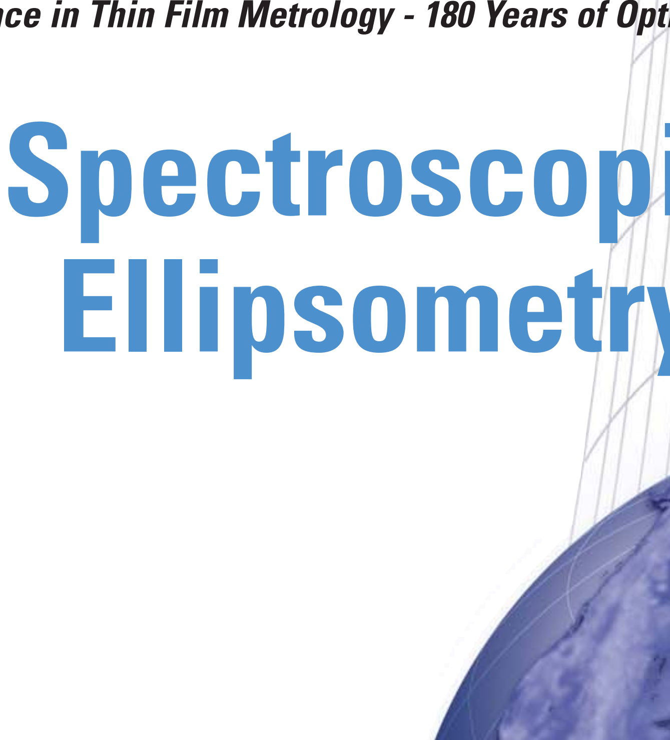


Excellence in Thin Film Metrology - 180 Years of Optical Expertise

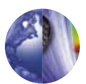

Spectroscopic Ellipsometry



Explore the future

HORIBA GROUP

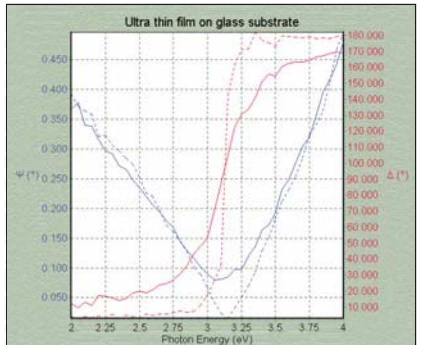
EMISSION • FLUORESCENCE • FORENSICS • GRATINGS & OEM • OPTICAL SPECTROSCOPY • RAMAN • THIN FILM



Film Thickness

- Accurate thin film measurement from a few angstroms to several microns
- For single layer or complex multilayer stacks

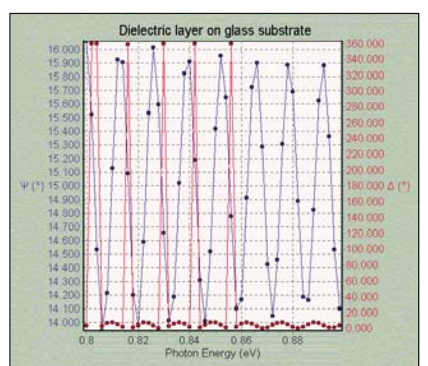
High sensitivity to ultra-thin films



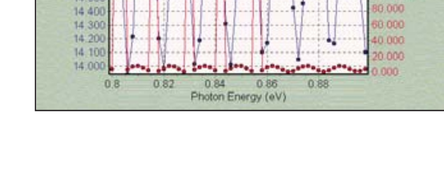
— Ultra-thin monolayer
- - - Fused silica substrate

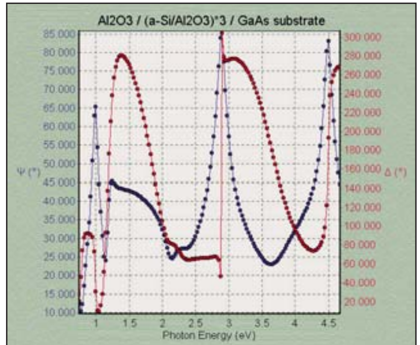
Change in signal for 10 Å thick monolayer at the Brewster angle

High resolution monochromator configuration



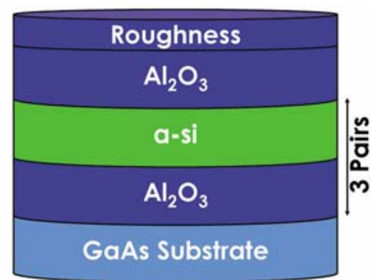
Ultra-thick dielectric layer (32µm)





Optically pumped semiconductor laser structure

Complex multilayer stack analysis

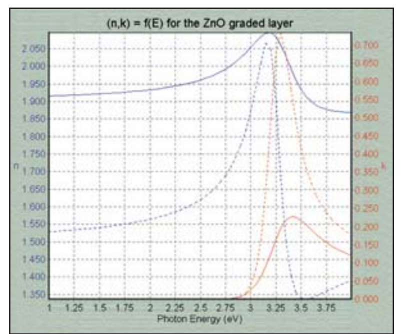


Spectroscopic Ellipsometry : Extensive Capabilities

Optical Properties

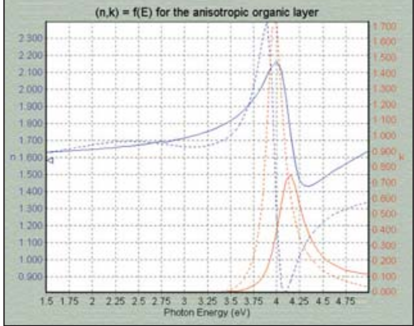
- Refractive index (n) and extinction cœfficient (k) from the far-UV to near-IR for complex materials, graded and anisotropic layers

(n,k) Evolution for a graded layer



ZnO thin film

Anisotropic layer characterization

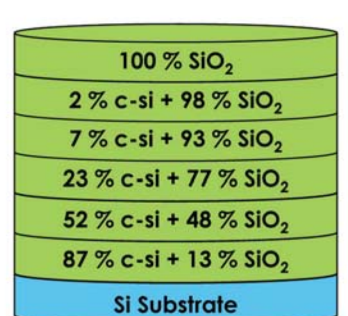


Organic film

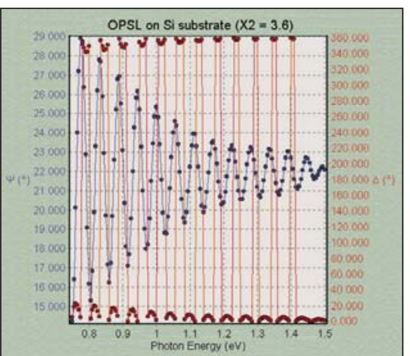
Advanced Metrology to

Composition / crystallinity •
Microstructure •
Film uniformity by area and depth •

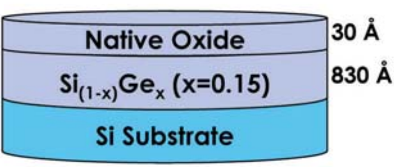
Inhomogeneity over depth: material proportion determination using EMA



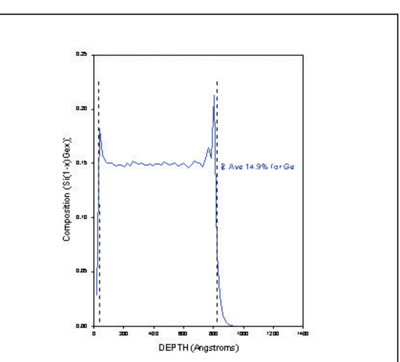
Ultra-thick OPSL layer



Ge concentration determination

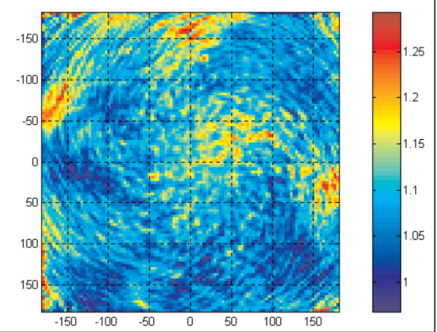


Excellent correlation between SIMS and ellipsometry



Automated sample mapping for area uniformity

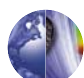
2D sample view



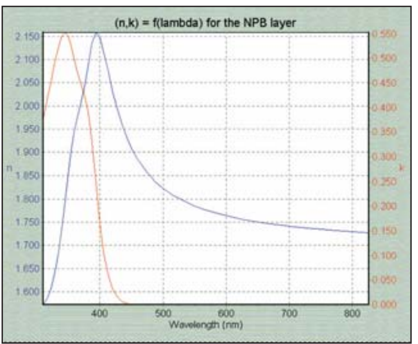
Strengthen your Competitive Edge

A Concentration of Advantages

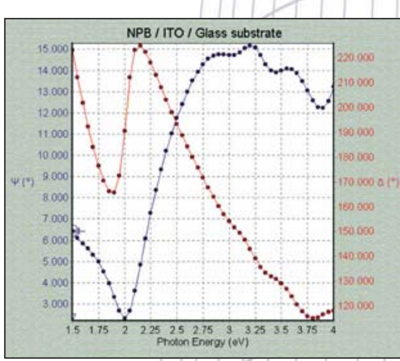
- Non-destructive technique
- Highly accurate & reproducible
- Can be used in any transparent and semi-transparent medium
- No reference material necessary
- Very sensitive, especially to ultra-thin films (< 10 nm)
- Simultaneous multiple parameter determination
- Measures data at wavelength of interest



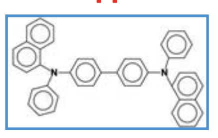
Chemistry & Biology



- Polymers
- Langmuir Blodgett films
- Liquid
- Lipids, protein adhesion

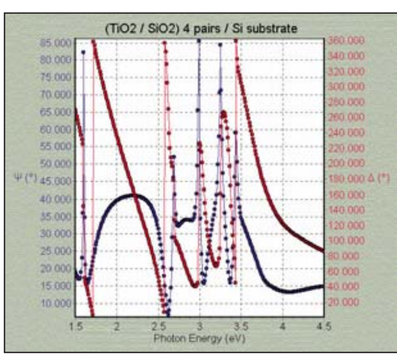


OLED application

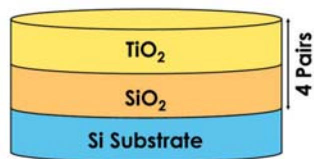


NPB electroluminescent organic film on ITO on glass substrate

Optical Coatings



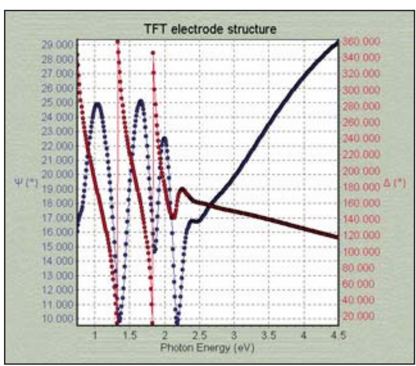
- Wave guides
- Laser mirrors, AR
- Photovoltaic applications



Anti-reflective coating application

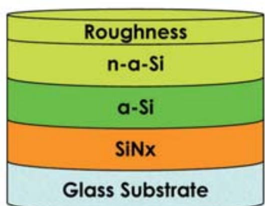
Widest Ellipsometry Applications Database

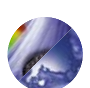
Flat Panel Displays



Flat Panel Display application

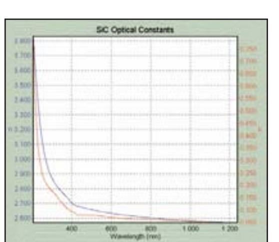
- Oxides, nitrides (ITO, MgO, TaO_x, Al_2O_3, SiN_x…)
- Amorphous silicon, polysilicon
- Colour filters
- Resist

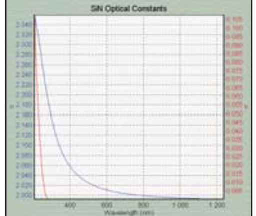


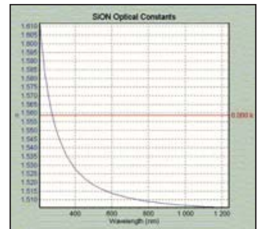


Dielectric Materials

- Nitrides, oxides, fluorides, carbides



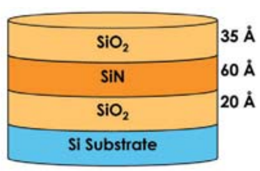




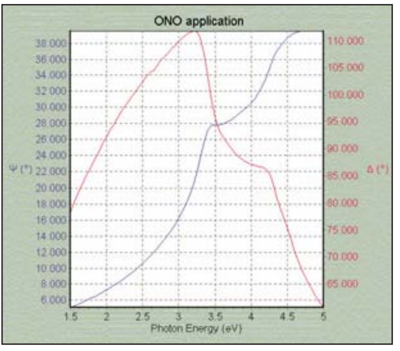
Three Applications Laboratories

Semiconductor Technology

- Oxides, nitrides, oxinitrides
- Thin NO capacitors, ONO, OPO, ONOPO
- SOI, SIMOX
- Metals (Ti, TiN, TaN, MoSi, WSi_x, Al, Cu, Co...)
- Photoresists, ARC
- High k, low k



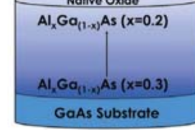
ONO application



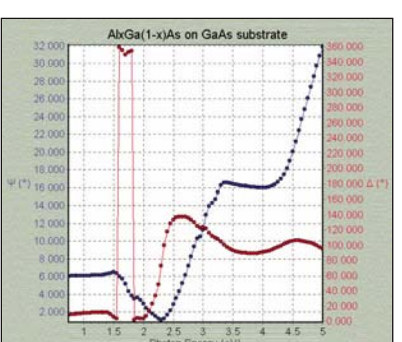
Alloys

- $Si_{(1-x)}Ge_{(x)}$, $Hg_{(1-x)}Cd_{(x)}Te$
- $Al_{(x)}Ga_{(1-x)}As$, InGaAsP
- Superlattices and MQW

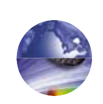
Determination of alloy gradient composition



III-V application



Real Time Process Control



- Thickness monitoring
- Growth and etch rates
- Endpoint detection
- Alloy composition
- Crystallinity
- Surface damage
- Contamination

Process control multilayer

Filter application

And Any Application That Needs Thin Film Characterization…

- Data storage
  CDR, CDR-W, DVD-R, DVD-RW
  Magneto-optic materials (Faraday or Kerr effect)
- Non linear optical devices
- Telecommunications...

for Providing Expert Solutions

UVISEL

UVISEL - Bench top configuration

Flexibility Combined with High Performance

The UVISEL Spectroscopic Phase Modulated Ellipsometer is a unique instrument that delivers the highest accuracy and precision for demanding research and industrial QC applications.

It covers a wide spectral range from 190 to 1700 nm, with a complete application database included in the software.

UVISEL
Fully integrated configuration

• Ex-Situ Configuration

The UVISEL instrument is highly featured and integrates high stability electronic systems with advanced software capabilities.
It is possible to automate the instrument to enhance its performance and range of application by adding many available options.

When integrated into a cabinet the UVISEL addresses the needs of industrial research and process development. Its advantages are a small footprint, an easy installation and clean-room compatibility.

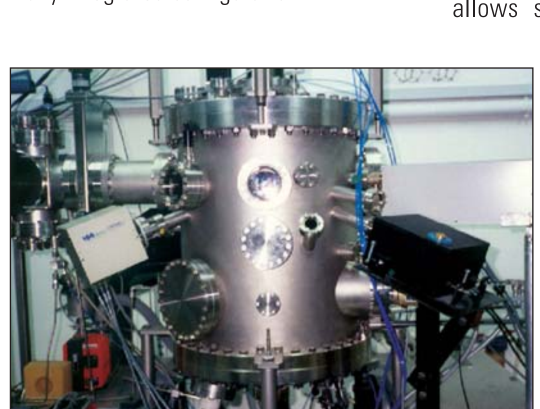
From Research to Industry

• In-Situ Configuration

By mounting the ellipsometer onto a process chamber the speed and stability of the in-situ UVISEL allows real-time monitoring and control of thin film deposition or etch processes with monolayer resolution.

The intrinsically high acquisition rate of the UVISEL allows sampling at millisecond time resolution, making it the ideal solution for in-situ monitoring and real-time control.

The in-situ UVISEL is routinely used in plasma deposition/etching, thermal oxidation, surface cleaning, implantation, corrosion, MBE, CVD, PVD, electrochemistry...

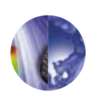


UVISEL coupled to CVD chamber

The Ultimate Tool for Powerful Research

SPECIFICATION TABLE ● standard ● option			UVISEL				
			Uvisel	Uvisel FUV	Uvisel NIR	Uvisel ER	Uvisel MWL
Spectral Range							
Visible - 240 - 830 nm			x				x
FUV - 190 - 830 nm				x			x
NIR - 260 - 1700 nm					x		
ER - 190 - 1700 nm						x	
Configuration							
Ex-situ	Bench top	● (standard)	Typical table layout : 150 wide x 100 deep x 85 high in cm				
	Cabinet	● (option)	Overall dimensions : 100 wide x 80 deep x 150 high in cm				
In-situ							●
Mechanical & Optical Parts							
Light Source	75 W Xe-lamp		●		●		●
	150 W Xe-lamp			●		●	●
Sample Stage	manual	● (standard)	Manual height (20 mm), tilt, theta adjustment				
	XY automatic	● (option)	8" supplied as standard with others sizes upon request				
Goniometer	manual	● (standard)	Manually adjustable angle from 55° to 75° by step of 5°				
	automatic	● (option)	Automatically adjustable angle from 40° to 90° by step of 0.01°				
Microspot	manual	● (standard)	3 positions : 0.05 - 0.1 - 1 mm				
	automatic	● (option)	4 positions : 0.06 - 0.12 - 0.25 - 1.2 mm (up to 0.03 mm upon request)				

Thin Film Production Control



Fast, Accurate and Stable to Ensure High Yields in Quality and Quantity

The UT-300 and FF-1000 instruments have been developed to provide specific process control solutions for the semiconductor and flat panel display industries. These accurate, automated thin film metrology tools deliver both unique performance and proven reliability for on-line quality control of production processes.

Equipped with achromatic microspot optics, wafer handling system, autofocus and pattern recognition software the UT-300 - Fully Automatic Ultra Thin Film Analyzer - accurately characterizes demanding thin film structures with a throughput in excess of 100 wafers/hour. The instrument has a deep-UV option (190 nm) and is compatible with 6", 8" and 12" wafers.

UT-300

The FF-1000 features all of the advantages of the UVISEL and UT-300 with a fully automated large area sample stage able to accept samples up to 1000 mm x 1000 mm.

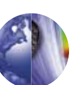
Two detection modes are available:

- scanning mode for highly accurate characterization of material physical properties (n, k, d, composition…)
- multiwavelength mode for fast and precise production control

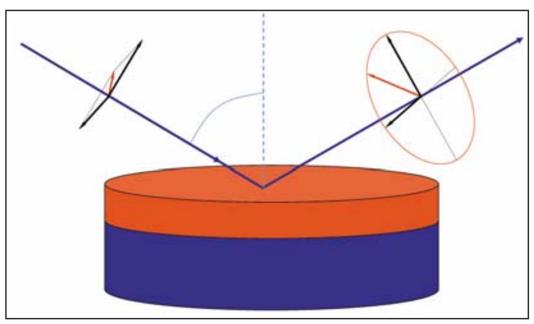
Powerful software based on Windows™ allows automated measurement and analysis of single or complex multiple layer stacks.

FF-1000

On-Line Control Oriented Systems



Phase Modulated Ellipsometry



Unequalled Capabilities for Accurate Ultra-Thin Film Characterization

Ellipsometry is based on the measurement of the light polarization change upon reflection from a sample surface or interface.
The experimental data are usually expressed as two parameters ψ and Δ, which are related to the Fresnel reflection coefficients by :

$$\rho = \frac{r_p}{r_s} = \tan\psi e^{i\Delta}$$

These two coefficients contain information related to material optical properties and physical dimensions. Spectroscopic ellipsometry measures this complex ratio ρ as a function of wavelength.

Three Key Factors for Success

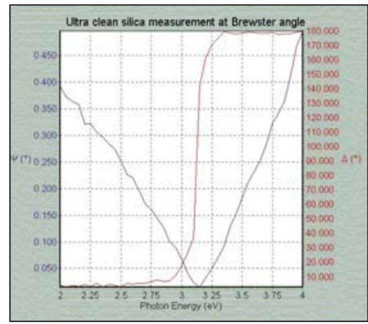
• The Most Accurate Measurement of Δ Parameter

Spectroscopic Phase Modulated Ellipsometers (SPME) use photoelastic devices to perform the polarization modulation without any mechanical movement, resulting in :

- Excellent signal/noise ratio from FUV to NIR
- No insensitive regions

This technology is consequently the best suited for accurate ultra-thin film measurement on transparent substrates.

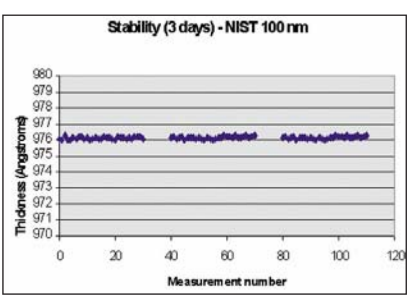
Uniqueness of Spectroscopic Phase Modulated Ellipsometry:
Accurate measurement of Δ around 0° and 180°



Measurement on ultra-clean silica at the Brewster angle

• High stability

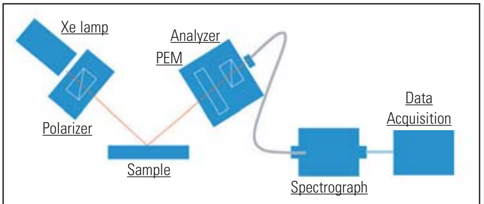
State-of-the-art control of PEM allows very high system stability.



Commitment to Excellence

• The Highest Data Acquisition Speed

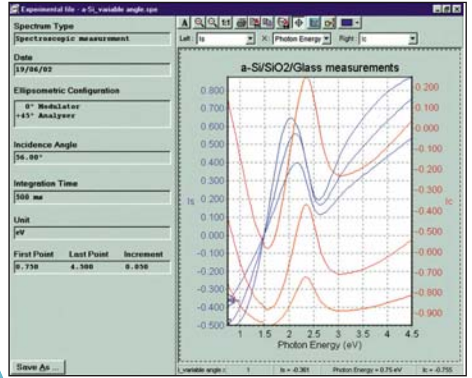
The 50 kHz modulation frequency of the Photoelastic Modulator (PEM) allows ultra fast acquisition at up to 1 ms per point for applications such as dynamic studies and liquid - surface measurements. The very high speed of the UVISEL in combination with digital signal averaging provides significant advantages over conventional ellipsometers.



Performance Specification

Advanced Spectroscopic Ellipsometry Software

Powerful DeltaPsi Windows™ based software makes full use of all the benefits provided by state-of-the-art JY ellipsometry hardware. The largest variety of advanced modelling functions gives research engineers the full performance of ellipsometric analysis. A simple user interface allows the operator to perform routine tasks very easily.



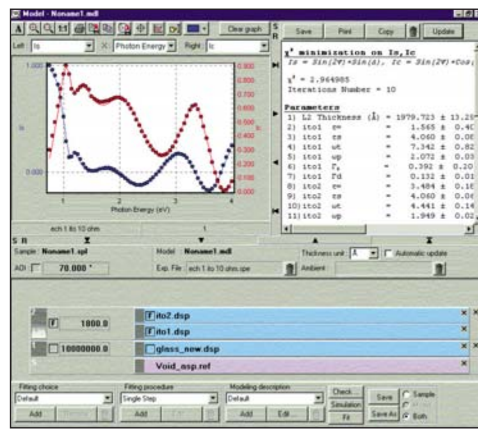
Variable angle measurements

Key Features

- Acquisition and analysis of ellipsometric, kinetic, transmission and reflection data
- Advanced mathematical fitting algorithms
- Bibliographic reference database - extendable
- Data and graphs easily transferred to Windows™ applications
- Import/export package functions for high flexibility in file manipulation

Enhanced Modelling Functions

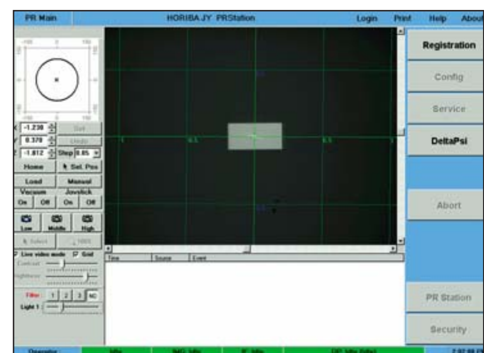
- Graded layer
- Roughness or interface
- Composition / crystallinity
- Anisotropic layer
- Thickness uniformity
- Depolarization factor
- Complete library of material properties based on dispersion relations
- Automatic backside correction for thick transparent substrates
- Periodic structure
- BLMC (proprietary mathematical algorithm) for ultra-thin film applications
- Multiguess, multistart, multimodel, correlation, ...



ITO graded layer model taking into account backside reflections

Simple Automatic Operation to Meet Production Needs

- Recipe procedure: data acquisition, analysis and mapping routines
- Fitting procedure
- Pattern recognition function
- 2D and 3D display views



Pattern recognition function

Defined and Optimized

Company History

Jobin Yvon SAS was created in 1819 and over the years distinguished scientists such as Fresnel, Babinet, Laurent, Fabry, Perot and Fizeau have worked in collaboration with our organization. Jobin Yvon provides state-of-the-art spectroscopic instrumentation and components and is today the leading supplier of optical spectrometer assemblies and subassemblies to original equipment manufacturers (OEMs). Our instruments respond to the needs of research and engineers wherever there is a need for accurate and reliable metrology tools.

The Thin Film Division was created by combining the cumulative optics experience of Jobin Yvon with the expertise and almost twenty years experience of SOFIE Instruments in thin film processing and plasma diagnostics.
By a process of continuous collaboration with major semiconductor manufacturers, research establishments and plasma processing equipment suppliers the Thin Film Division has developed a wide range of instruments dedicated to advanced thin film metrology such as Ellipsometry, Optical Emission Spectroscopy (OES) and Interferometry.

Our instruments are manufactured under a strict quality assurance program with the aim to satisfy customer needs by the highest level of quality and performance.

Pursuing a tradition of innovation Jobin Yvon acquired the license for a Phase Modulated Ellipsometer developed in collaboration with CNRS laboratories (license Anvar-Ecole Polytechnique).
In 1992 this collaboration won an Award for research-to-industry technology transfer, and Jobin Yvon successfully developed a broad variety of spectroscopic ellipsometry instruments from this base.

Jobin Yvon Spectroscopic Ellipsometers provide the highest level of performance currently available with continuous improvement in terms of hardware performance and analysis software.

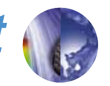
This commitment to product excellence and continued support is part of JY's culture.

Building Relationships with Creative Solutions

Reliability and Continued Support

We are committed to give you the right answer the first time.

Call us and let us work together!

Service and Application Support 

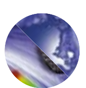
A Worldwide Experienced Service Team for Your Technical Support

Jobin Yvon offers a complete range of service and preventative maintenance plans to fit your needs and for your complete satisfaction.
Purposes of this contract are :

- System installation
- Technical training for a smooth and carefree start up
- Regular preventative maintenance actions to keep your instrument in its best working condition

Our staff of highly trained service and application engineers stand ready to provide assistance when and where you need it.

- Application training programs - advanced or basic -
- Training session seminars on site
- Sample analysis support for new applications
- Software configuration according to your applications
- Supplies, accessories and upgrades for the future growth of your instrument

Sample Measurement Service 

Jobin Yvon offers sample measurement services in its application lab.
The laboratory is equipped with ellipsometers from FUV to NIR including all options.
An expert application team will characterize your samples and provide you with a detailed analysis report.

Our extensive experience in ellipsometry applications has allowed us to compile the widest analysis database.
Feel free to contact the sales division for a quotation, in relation with our application engineers for the most appropriate technical evaluation.

Global Network

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