

THETAMETRISIS

CATALOG



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Principle of operation

ThetaMetrisis FR-tools (FR-pRo, FR-ES, FR-Scanner, FR-uProbe/FR-Mic, FR-Ultra) are utilized for measuring the **thickness** and **optical constants (n & k)** of dielectric, resist, metal, and semiconductor films within the **thickness range of 1 nm to 3000 μm** . The principle of operation for FR-tools is **White Light Reflectance Spectroscopy (WLRs)**, a **precise, fast, and non-destructive** methodology that necessitates minimal or no sample preparation.

In FR-tools the **White Light Reflectance Spectroscopy (WLRs)*** methodology is implemented. **WLRs** utilizes light intensity to gauge the reflection from thin films or multilayer stacks across various wavelengths, with incident light striking the sample surface perpendicularly. This spectral reflectance technique is capable of assessing thickness, roughness, uniformity, and optical constants of a wide array of thin films. WLRs doesn't directly measure physical properties; rather, it gauges the optical response elicited by these properties within the system. Thus, resolving this inverse problem requires a numerical solution, achieved by aligning measured and calculated data to find the best fit. This way, the actual physical properties of interest—e.g. layer thicknesses and optical properties—are inferred.

WLRs methodology involves a light source a miniaturized spectrometer, and a reflection probe. The light emitted from the source is guided onto the sample under investigation through a reflection optical probe, fibers a1-a6, **Fig. 1a**. The typical sample consists of a stack of transparent and semi-transparent films over an appropriate reflective or transmitting substrate (e.g. Si wafer, a glass slide). The beam from the light source interacts with the sample (**Fig. 1b**) and produces a reflectance signal. The reflection probe collects the reflected beam (through the fiber b, **Fig. 1a**), directing it to the spectrometer. Due to the optical path difference, the various beams have undergone, interference fringes are monitored on the spectrometer. A typical reflectance spectrum from a SiO_2 layer on Si is illustrated in **Fig. 2**. In the same figure, the incident (reference) spectrum is also illustrated. The number and the shape of interference fringes depend on the thickness and the refractive index of the layer stack. By fitting the reflectance spectrum with appropriate physical models and algorithms the film thicknesses and the refractive indices of the films are calculated, **Fig. 3**.

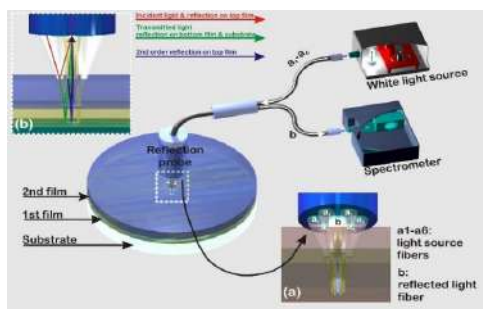


Figure 1: Typical WLRs setup. (a) Detail of the configuration of Reflection Probe, (b) detail of the light optical path through a two-layer sample.

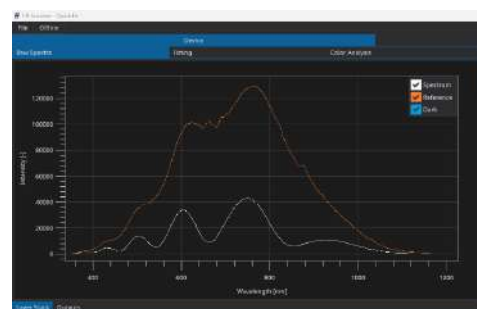


Figure 2: Reflectance spectra from SiO_2/Si (white curve), from an ideal reflector (orange curve) and the dark spectrum (blue curve).



Figure 3: Normalized specular reflectance (interference) spectra: experimental (red curve), fitted (green curve).

* D.Goustouridis, I.Raptis, Th.Mpatzaka, S.Fournari, G.Zisis, P.Petrou "Non-Destructive Characterization of Selected Types of Films and Other Layers via White Light Reflectance Spectroscopy (WLRs)" *Micro* 2 495(2022)

Single Spot Tools

FR-pRo: Build2Order film characterization tool

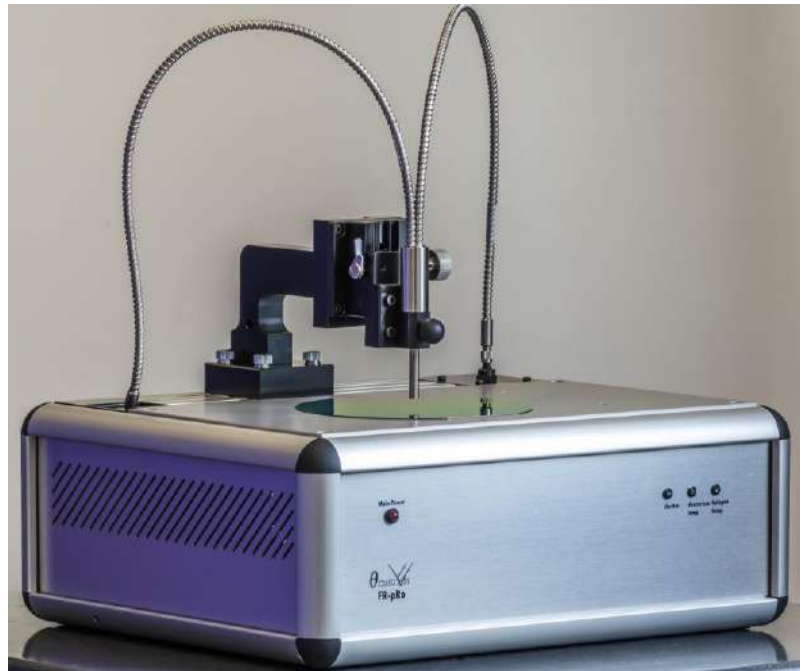
FR-pRo: the modular & expandable platform for the characterization of coatings in the **1nm-3mm** thickness range.

FR-pRo tools are tailored to meet the user needs for a wide range of diverse non-destructive characterization applications, such as: Film thickness, Refractive Index, Color, Transmittance, Reflectance, Film Characterization under temperature or ambient controlled environment or in liquid environment and many more ...

Applications

- **Univ. & Research labs**
- **Semiconductors**
- **Polymer & Resist characterization**
- **Chemical measurements**
- **Dielectric characterizations**
- **Biomedical**
- **Hardcoats, Anodization, Metal parts process**
- **Optical Coating**
- **non-metal Films**
- **And many more...**

(Contact us with your requirements)



FR-pRo tool is assembled by user selected modules. The Core Unit accommodates the light source, the spectrometer (for any spectral regime in the 190nm-2500nm range) and the control & communication electronics. The tool comes with a set of reference samples (Si reference, SiO₂/Si, Si₃N₄/SiO₂/Si). Then, there is a wide range of Accessories, such as:

- **Film Thickness kit** for reflectance measurements,
- **FR-Mic** for measurements at very small areas,
- **Manual & Motorized stages,**
- **Film/Cuvette Holder** for Absorbance / Transmittance and chemical concentration measurements,
- **Thermal or Liquid kits** for measurements under controlled Temperature or in Liquid environment,
- **Integration Spheres** for diffuse & total reflectance

By the combination of different modules, the final set-up meets any end-user needs

FEATURES

- Single-click analysis (no need for initial guess)
- Dynamic measurements
- Measurement of n & k, color
- Multiple installations for off-line analysis



SPECIFICATIONS (STANDARD CONFIGURATIONS)*

Model	UV/VIS	UV/NIR -EXT	UV/NIR-HR	D UV/NIR	VIS/NIR	D Vis/NIR	NIR	NIR-N1	NIR-N2	NIR-N3	NIR-N4
WL Range -nm	200 – 850	200 –1020	190-1100	200 – 1700	380 –1020	380 – 1700	900 – 1700	850-1050	900 - 1050	1280-1350	1520-1580
Pixels	3648	3648	2048	3648 & 512	3648	3648 & 512	512	3648	3648	512	512
Min Thick -SiO ₂	1nm	1nm	1nm	1nm	12nm	12nm	50nm	1um	4μm	12um	20um
Max Thick SiO ₂	80μm	90μm	100μm	250μm	120μm	250μm	250μm	500μm	1.0mm	2mm	3mm
Max Thick -Si								300μm***	450μm***	1mm***	1.3mm***
n&k -Min Thick	50nm	50nm	50nm	50nm	100nm	100nm	500nm		-	-	-
Thick. Accuracy **	1nm / 0.2%	1nm / 0.2%	1nm / 0.2%	1nm / 0.2%	2nm / 0.2%	2nm / 0.2%	3nm / 0.4%	50nm / 0.2%	50nm / 0.2%	50nm / 0.2%	50nm / 0.2%
Thick. Precision**			0.05nm		0.05nm	0.05nm	0.1nm	0.1nm	5nm	5nm	5nm
Thick. stability **			0.05nm		0.05nm	0.05nm	0.15nm	0.15nm	5nm	5nm	5nm
API support		YES			YES	YES	YES	YES	YES	-	-
Light Source	Internal Deuterium (2000h) & Halogen (3000h)				Halogen (internal), 3000h (MTBF)				SLED (150Kh)		
Integration Time	5msec (min)				5msec (min)				20msec (min)		
Size/Weight	FR-pRo: 39x32x17cm (LxWxH) 10Kg, FR-pRo D: 45x32x19cm (LxWxH) 13Kg										
Power	110V/230V, 50-60Hz										
Spot size	Diameter of ~350-400um (smaller spot size options are available upon request)										
Material Database	> 800 different materials										
SW Characteristics	FR-Monitor v4.0 (free of charge updates) Full S/W details are listed at the related catalog's page										

ACCESSORIES

Film/Cuvette kit
Transmittance stage
Lens Module
Contact probe
Microscope
Scanner (motorized)
Integration sphere
Manual X-Y stage
Thermal Module

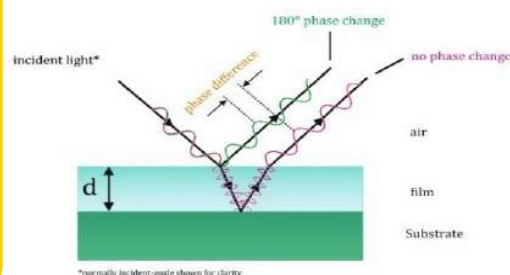
Transmission measurements of films or liquids in standard cuvettes
Stage upgrade to support transmittance measurements
-Measurements on coatings where a small spot-size is required
Thickness & optical measurements of coatings in the field. Ideal for curved surfaces
Microscope-based reflectance / transmittance and thickness measurements with high lateral resolution
Polar (R-Θ) or Cartesian (X-Y) automated stage with wafer chuck. Reflectance& transmittance
For the characterization of specular and diffuse reflectance of coatings and surfaces
Manual X-Y stage for measurements over an area of 100mm x 100mm or 200mm x 200mm
Computer controlled Hot plate embedded in the FR-tool (Room temperature - 200°C, 0.1°C accuracy)

And many more.....



PRINCIPLE OF OPERATION

White Light Reflectance Spectroscopy (WLRS) measures the amount of light reflected from a film or a multilayer stack over a spectral range, with the incident light normal (perpendicular) to the sample surface. The measured reflectance spectrum, produced by interference from the individual interfaces is being used to determine the thickness, optical constants (n & k), etc. of free-standing and supported (on transparent or partially/fully reflective substrates) stack of films.



* Specifications are subject to change without any notice; ** Thickness range depends on the spectral range and refers to a single layer with refractive index ~1.5 over Si or similar substrate ** Measurements compared with a calibrated spectroscopic ellipsometer and XRD, Average of standard deviation of mean value over 15 days. Sample: 1micron SiO₂ on Si wafer, Standard deviation of 100 thickness measurements. Sample: 1micron SiO₂ on Si wafer, 2*Standard-Deviation of daily average over 15 days. Sample: 1micron SiO₂ on Si wafer. *** For Double Side Polished Si wafer

FR-ES: Compact entry level system

FR-ES is a compact and light-weighted unit for the non-destructive characterization of transparent and semi-transparent coatings in a wide thickness range and of thin metallic layers.

FR-ES is the ideal configuration for research labs.

With FR-ES, the user can perform reflectance and transmittance measurements in various spectral ranges.

APPLICATIONS

- **Univ. & Research labs**
- **Semiconductors**
- **Polymer & Resist characterization**
- **Chemical measurements**
- **Dielectric characterizations**
- **Biomedical**
- **Hardcoat, Anodization, Metal parts process**
- **Optical Coating**
- **non-metal Films**
- **And many more...**

(contact us with your requirements)



FR-ES platform is designed to provide excellent performance in terms of characterization of coatings at a small footprint. It is employed in a wide range of diverse measurement applications: Film thickness, Refractive Index, Color, Transmittance, Reflectance, and many more. There are five FR-ES configurations available:

VIS/NIR (380-1020nm),
UV/VIS (200-850nm),
UV/NIR-EXT (200-1000nm),
UV/NIR-HR (190-1100nm)
NIR-N1 (850-1050nm),
NIR (900-1700nm).

Then, there is a wide range of Accessories, such as:

- **Filters** to block light at certain spectral regimes
- **FR-Mic** for measurements at very small areas,
- **Manual stage**, 25x25mm, 100x100mm or 200x200mm
- **Film/Cuvette Holder** for Absorbance / Transmittance and chemical concentration measurements,
- **Integration Spheres** for diffuse & total reflectance

FEATURES

- Single-click analysis (no need for initial guess)
- Dynamic measurements
- Measurement of n & k, color
- Multiple installations for off-line analysis



SPECIFICATIONS (STANDARD CONFIGURATIONS)*

Model	VIS/NIR	NIR	NIR-N1	D VIS/NIR	UV/VIS	UV/NIR-EXT	UV/NIR-HR
WL Range -nm	380 – 1020	900 – 1700	850-1050	380-1700	200-850	200-1000	190-1100
Pixels	3648	512	3648	3748 & 512	3648	3648	2048
Min Thick -SiO₂	12nm	50nm	1μm	12nm	1nm	1nm	1nm
Max Thick SiO₂	120μm	250μm	500μm	250μm	80μm	90μm	100μm
n&k -Min. Thickness	100nm	500nm		100nm	50nm	50nm	50nm
Thick. Accuracy **,	2nm / 0.2%	3nm / 0.4%	50nm / 0.2%	2nm / 0.2%	1nm / 0.2%	1nm / 0.2%	1nm / 0.2%
Thick. Precision **,	0.05nm	0.1nm	0.1nm	0.05nm		0.05nm	
Thick. stability **,	0.05nm	0.15nm	0.15nm	0.05nm		0.05nm	
API support	YES						
Light Source	Halogen (internal), 3000h (MTBF)				VIS/NIR operation: Halogen (internal), 3000h (MTBF) UV/NIR operation: LS-2, Deuterium -Halogen, 2000h (MTBF)		
Integration Time	5msec (min)	0.5msec (min)	5msec (min)	5msec (min)	5msec (min)		1msec (min)
Spot size	Diameter of ~350-400μm (smaller spot size as option)						
Material Database	> 800 different materials						
Dimensions/Weight	FR-ES: 20x22x6cm (LxWxH), 1.8Kg (stage excluded), FR-ES D: 20x27x12cm (LxWxH), 3.3Kg (stage excluded)						
Power	110V/230V, 50-60Hz, 20-50W (LS-2, external light source is excluded)						
SW Characteristics	FR-Monitor v4.0 (free of charge updates) Full S/W details are listed at the related catalog's page						

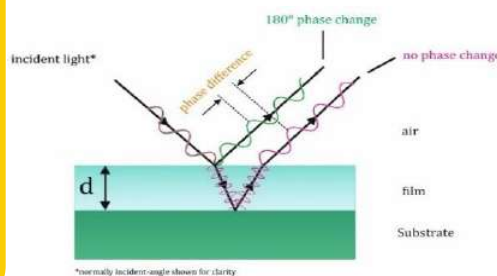
ACCESSORIES

Focusing module	Optical module attached on the reflection probe for <100μm diameter spot size
Transmittance module	Optical module for transmittance/absorbance measurements
Film/Cuvette kit	Transmission measurements of films or liquids in standard cuvettes
Contact probe	Thickness & optical measurements of coatings in the field. Ideal for curved surfaces
Microscope	Microscope-based reflectance and thickness measurements with high lateral resolution
Manual X-Y stage	Manual X-Y stage for measurements over an area of 25x25mm / 100x100mm / 200x200mm



PRINCIPLE OF OPERATION

White Light Reflectance Spectroscopy (WLRS) measures the amount of light reflected from a film or a multilayer stack over a spectral range, with the incident light normal (perpendicular) to the sample surface. The measured reflectance spectrum, produced by interference from the individual interfaces is being used to determine the thickness, optical constants (n & k), etc. of free-standing and supported (on transparent or partially/fully reflective substrates) stack of films.



* Specifications are subject to change without any notice; ** Thickness range depends on the spectral range and refers to a single layer with refractive index ~1.5 on Si substrate ** Measurements compared with a calibrated spectroscopic ellipsometer and XRD, Average of standard deviation of mean value over 15 days. Sample: 1μm SiO₂ on Si, Standard deviation of 100 thickness measurements. Sample: 1μm SiO₂ on Si, 2*Standard-Deviation of daily average over 15 days. Sample: 1μm SiO₂ on Si.

FR-ES LAN: Compact entry level system with Ethernet communication

FR-ES-LAN is an extended configuration of FR-ES and is equipped with CMOS pixel array that provide short integration times and with LAN communication for demanding applications.. With FR-ES-LAN the user can perform reflectance and transmittance measurements in various spectral ranges.

APPLICATIONS

- **Univ. & Research labs**
- **Semiconductors**
- **Polymer & Resist characterization**
- **Chemical measurements**
- **Dielectric characterizations**
- **Biomedical**
- **Hardcoat, Anodization, Metal parts process**
- **Optical Coating**
- **non-metal Films**
- **And many more...**

(contact us with your requirements)



FR-ES-LAN platform is designed to provide excellent performance in terms of characterization of coatings at unparalleled speed (up to 4000 measurements/sec). It is employed in a wide range of diverse measurement applications: Film thickness, Refractive Index, Color, Transmittance, Reflectance, and many more. There are five configurations available:

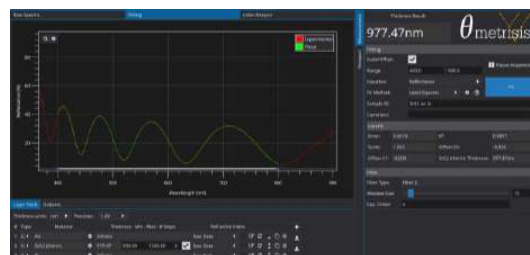
VIS/NIR (380-1020nm),
UV/VIS (200-850nm),
UV/NIR-EXT (200-1000nm),
NIR-N1 (850-1050nm),

Then, there is a wide range of Accessories, such as:

- **Filters** to block light at certain spectral regimes
- **FR-Mic** for measurements at very small areas,
- **Manual stage**, 25x25mm, 100x100mm or 200x200mm
- **Film/Cuvette Holder** for Absorbance / Transmittance and chemical concentration measurements,
- **Integration Spheres** for diffuse & total reflectance

FEATURES

- Single-click analysis (no need for initial guess)
- Dynamic measurements
- Measurement of n & k, color
- Multiple installations for off-line analysis



SPECIFICATIONS (STANDARD CONFIGURATIONS)*

Model	VIS/NIR	NIR-N1	UV/VIS	UV/NIR-EXT
WL Range -nm	380 –1020	850-1050	200-850	200-1000
Pixels		2048		
Min Thick -SiO₂	12nm	1μm	1nm	1nm
Max Thick SiO₂	90μm	500μm	80μm	90μm
n&k -Min. Thickness	90nm		50nm	50nm
Thick. Accuracy **,	2nm / 0.2%	50nm / 0.2%	1nm / 0.2%	1nm / 0.2%
Thick. Precision*,**	0.05nm		0.05nm	0.05nm
Thick. stability **,	0.05nm		0.05nm	0.05nm
API support		YES		
Light Source	For VIS/NIR operation: Halogen (internal), 3000h (MTBF) For UV/NIR operation: LS-2, Deuterium -Halogen, 2000h (MTBF)			
Integration Time	20μmsec (min)			
Spot size	Diameter of ~350-400μm (smaller spot size as option)			
Material Database	> 800 different materials			
Dimensions/Weight	20x19x9cm (LxWxH), 2.5Kg (stage excluded)			
Power	110V/230V, 50-60Hz, 20-50W			
Communication	USB and LAN			
SW Characteristics	FR-Monitor v4.0 (free of charge updates) Full S/W details are listed at the related catalog's page			

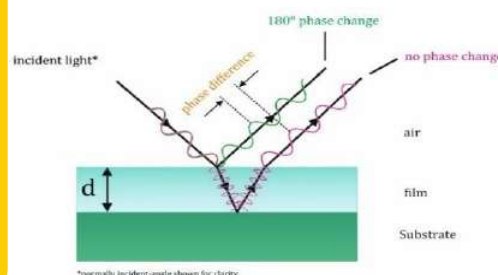
ACCESSORIES

Focusing module	Optical module attached on the reflection probe for <100μm diameter spot size
Transmittance module	Optical module for transmittance/absorbance measurements
Film/Cuvette kit	Transmission measurements of films or liquids in standard cuvettes
Contact probe	Thickness & optical measurements of coatings in the field. Ideal for curved surfaces
Microscope	Microscope-based reflectance and thickness measurements with high lateral resolution
Manual X-Y stage	Manual X-Y stage for measurements over an area of 25x25mm /100x100mm / 200x200mm



PRINCIPLE OF OPERATION

White Light Reflectance Spectroscopy (WLRS) measures the amount of light reflected from a film or a multilayer stack over a spectral range, with the incident light normal (perpendicular) to the sample surface. The measured reflectance spectrum, produced by interference from the individual interfaces is being used to determine the thickness, optical constants (n & k), etc. of free-standing and supported (on transparent or partially/fully reflective substrates) stack of films.



* Specifications are subject to change without any notice; ** Thickness range depends on the spectral range and refers to a single layer with refractive index ~1.5 on Si substrate ** Measurements compared with a calibrated spectroscopic ellipsometer and XRD, Average of standard deviation of mean value over 15 days. Sample: 1μm SiO₂ on Si, Standard deviation of 100 thickness measurements. Sample: 1μm SiO₂ on Si, 2*Standard-Deviation of daily average over 15 days. Sample: 1μm SiO₂ on Si.

FR-pOrtable: USB-powered for Point-of-Need

FR-pOrtable: the radical handy solution for accurate, precise & non-destructive characterization of transparent and semi-transparent single films or stack of films. It is powered through the same USB 2.0/3.0 port used for data transfer and can be easily used at the field (the tool comes over the sample).

APPLICATIONS

- **Univ. & Research labs**
- **Semiconductors** (Oxides, Nitrides, Si, Resists, etc.)
- **MEMS devices** (Photoresists, Si membranes, etc.)
- **LED**
- **Data Storage**
- **Hard/Soft coatings on curved substrates**
- **Polymer coatings, adhesives, etc.**
- **Biomedical** (parylene, balloon wall thickness, etc.)
- **And more...**
(Contact us with your requirements)



The compact size of **FR-pOrtable** along with the custom designed reflection probe, and the long lifetime (20.000h) broad-band light source guarantee highly accurate and repeatable reflectance & transmittance measurements.

FR-pOrtable, can be either mounted on the supplied base/stage or can be easily transformed to a handheld thickness measurement tool to be placed over the sample under characterization.

FR-pOrtable is the robust & accurate thickness gauge for real-time characterization of coatings in industrial environment (e.g. R2R, belt conveyor...).

FR-pOrtable is the only USB-powered optical characterization tool for in-field applications.

FEATURES

- Single-click analysis (no need for initial guess)
- Dynamic measurements
- Measurement of n & k, color
- Multiple installations for off-line analysis
- Free of-charge Software update



SPECIFICATIONS*

Thickness range

12nm – 120μm

Refractive Index calculation

✓ (100nm min. thickness)

Thickness Accuracy*

0.2% or 2nm

Thickness Precision*

0.02nm

Thickness stability**

0.05nm

Sample size

1mm to 180mm and up

Spectral Range

380nm – 1020nm

Working distance

3mm-20mm

Spot size

~350-400μm (diameter)

Light Source

Hybrid (LEDs and incandescence lamp) 20000h (MTBF)

Wavelength resolution

0.8nm

Number of Layers Measured

Max. 5 layers

Measurement time (min)

10ms

A/D converter

16 bit

API support

YES

Power

USB – supplied (USB 2.0/3.0)

Dimensions

300mm x 110mm x 40mm

Material Database

> 800 different materials

SW Characteristics

FR-Monitor v4.0 (free of charge updates) Full details are listed at the related catalog's page

ACCESSORIES

At-the-Field adaptor:

For measurements at the Point-of-Need.

Transmittance module:

For the measurement of transmittance & absorbance spectra of coatings, coating thickness etc.

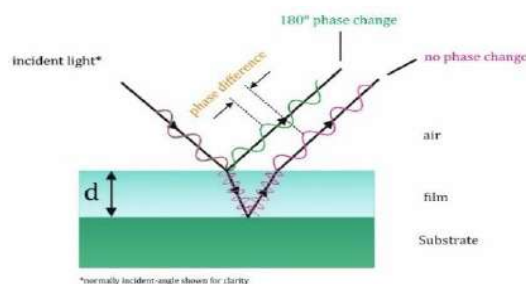
Manual X-Y stage:

For the characterization of coatings at multiple positions (manual movement)

PRINCIPLE OF OPERATION

White Light Reflectance Spectroscopy (WLRs) measures the amount of light reflected from a film or a multilayer stack over a spectral range, with the incident light normal (perpendicular) to the sample surface.

The measured reflectance spectrum, produced by interference from the individual interfaces is being used to determine the thickness, optical constants (n & k), etc. of free-standing and supported (on transparent or partially/fully reflective substrates) stack of films.



* Specifications are subject to change without any notice; ** Thickness range depends on the spectral range and refers to a single layer with refractive index ~1.5 over Si or similar substrate
 ** Measurements compared with a calibrated spectroscopic ellipsometer and XRD, Average of standard deviation of mean value over 15 days. Sample: 1micron SiO₂ on Si wafer, Standard deviation of 100 thickness measurements. Sample: 1micron SiO₂ on Si wafer, 2*Standard-Deviation of daily average over 15 days. Sample: 1micron SiO₂ on Si wafer.

FR-Ultra: wafer thickness measurement system

FR-Ultra is a unit dedicated for the fast, accurate and non-destructive measurement of thick and ultra-thick semiconductor and transparent layers.



FR-Ultra is a dedicated tool for the accurate measurement of thick and ultra-thick layers from semiconducting and/or dielectric materials. Thanks to its advanced optics, FR-Ultra can measure either smooth or rough films & substrates of very high thickness.

Typical applications include:

Thickness measurement of thick glasses (up to 2mm in thickness either clear or haze)

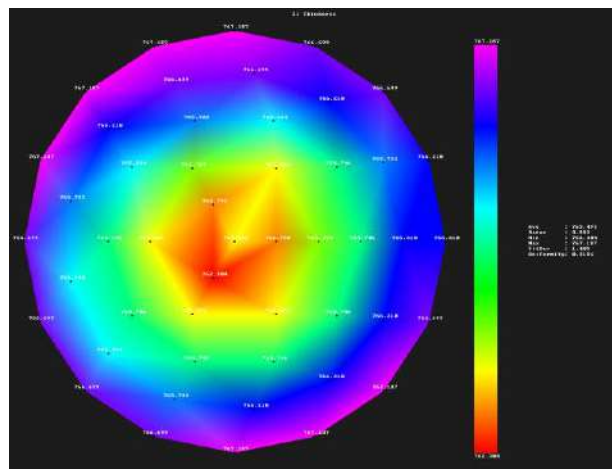
Thickness measurement of wafers (e.g. Single or Double Side Polished wafers up to 12in in diameter).

FR-Ultra can be easily integrated with Cartesian and Polar stages for thickness mapping over large areas.

APPLICATIONS

- Univ. & Research labs
- Semiconductors
- Polymer & Resist characterization
- Dielectric characterizations
- Hardcoat, Anodization,
- And many more...

(contact us with your requirements)



Wafer Thickness map (12inch Si wafer)

FEATURES

- Single-click analysis (no need for initial guess)
- Dynamic measurements
- 800+ materials
- Multiple installations for off-line analysis
- Free of-charge Software update



SPECIFICATIONS*

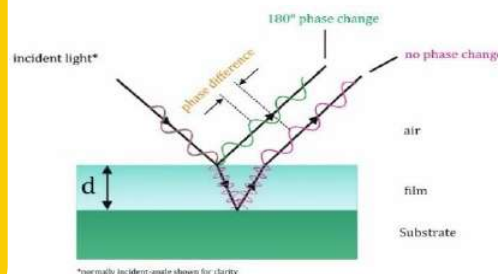
Model	NIR-N3			VIS/NIR		
WL Range -nm	1280-1350			380-1000		
Pixels	512			2048		
Thick. Accuracy**	0.4%			0.2%		
API support	-			-		
Light Source	SLED (internal), >150000h (MTBF)			Tungsten, 2000h (MTBF)		
Integration Time	5msec (min)			5msec (min)		
Objective Lens	5X	10X	20X	5X	10X	20X
Thickness range (n=1.5)	10μm – 2mm	10μm – 2 mm	10μm – 1.9 mm	10μm – 2mm	10μm – 2 mm	10μm – 1.9 mm
Si Thickness range (n=3.5)	7μm – 1mm	7μm – 1 mm	7μm – 0.9mm	7μm – 1mm	7μm – 1 mm	7μm – 0.9mm
Spot size	40μm	18μm	12μm	40μm	18μm	12μm
Nominal WD	45mm	34mm	31mm	45mm	34mm	31mm
WD tolerance @100 μm	16mm	4mm	1.2mm	16mm	4mm	1.2mm
WD tolerance @500μm	4mm	1.2mm	0.8mm	4mm	1.2mm	0.8mm
Material Database	> 800 different materials					
Dimensions/Weight	39x32x22cm (LxWxH), 13Kg (stage excluded)					
Power	110V/230V, 50-60Hz, 50W			110V/230V, 50-60Hz, 30W		
SW Characteristics	FR-Monitor v4.0 (free of charge Updates)					

ACCESSORIES

Camera	Optical module for visualization of the area under characterization and measurement spot
Stage	XY-A200 (200mm travel) or RΘ-150 (300mm diameter) stage for wafer mapping

PRINCIPLE OF OPERATION

White Light Reflectance Spectroscopy (WLRS) measures the amount of light reflected from a film or a multilayer stack over a spectral range, with the incident light normal (perpendicular) to the sample surface. The measured reflectance spectrum, produced by interference from the individual interfaces is being used to determine the thickness, optical constants (n & k), etc. of free-standing and supported (on transparent or partially/fully reflective substrates) stack of films.



* Specifications are subject to change without any notice;

** Measurement on 100μm DSP Si wafer. Values correspond to the criterion of keeping the measured thickness value within the accuracy range (0.4%)

*** Measurement on 500μm DSP Si wafer. Values correspond to the criterion of keeping the measured thickness value within the accuracy range (0.4%)

FR-Mini: Tool for university labs

FR-Mini is a compact unit especially designed for usage at university educational and research laboratories for the fast, accurate and non-destructive characterization of a wide range of diverse coatings.

With FR-Mini the user can easily perform reflectance and/or transmittance measurements in a wide spectral range as well.

APPLICATIONS

- **Univ. & Research labs**
- **Semiconductors** (Oxides, Nitrides, Si, Resists, etc.)
- **MEMS devices** (Photoresists, Si membranes, etc.)
- **Solar cells**
- **Polymer coatings**, adhesives, etc.
- And many more...
(contact us with your requirements)



FR-Mini platform is designed to provide state-of-the-art characterization of films (either supported on reflective and transparent substrates or un-supported films (e.g. PET foils) in a wide thickness range either for single or multi-layer stacks.

The tool is equipped with stabilized tungsten light source that ensure long operational lifetime without the need for frequent referencing.

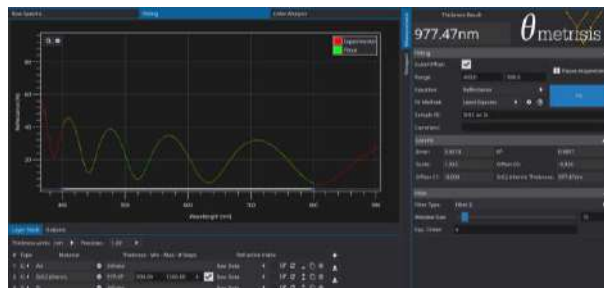
FR-Mini is controlled by the same software, (FR-Monitor 4.0) used for more advanced FR-tools and is loaded with extremely large materials database and supports either static or dynamic measurements.

The tool is connected with any modern Windows PC through USB port. The set-up lasts few minutes only and the user can operate the tool immediately without any particular knowledge of optics.

FR-Mini can be employed in a wide range of diverse applications, such as: Film thickness, Refractive Index, Transmittance, Reflectance, and many more.

FEATURES

- Single-click analysis (no need for initial guess)
- Dynamic measurements
- Measurement of n & k
- Multiple installations for off-line analysis
- Free of-charge Software update



SPECIFICATIONS*

Model	VIS	VIS/NIR-LC	VIS/NIR	UV/NIR-HR
WL Range -nm	400 –850	380-1050	380-1000	190-1100
# Pixels	512	1024	2048	2048
Min Thick -SiO₂	20nm	15nm	15nm	1nm
Max Thick SiO₂	40um	50um	90um	100um
n&k -Min. Thickness	500nm	100nm	100nm	50nm
Thick. Accuracy **	4nm / 0.5%	3nm / 0.4%	2nm / 0.2%	1nm / 0.2%
Thick. Precision**	0.2nm		0.1nm	0.05nm
Thick. stability**	0.2nm		0.1nm	0.05nm
Light Source	Tungsten (internal), >3000h (MTBF)			
Integration Time	10msec (min)	1msec (min)	5msec (min)	0.5msec (min)
Spot size	Diameter of ~350-400um (smaller spot size as option)			
Material Database	> 800 different materials			
Dimensions/Weight	26x16x10cm (LxWxH), stage is not included			
Weight	1.6Kg (stage is not included)			
Power	110V/230V, 50-60Hz, 10W			
SW Characteristics	FR-Monitor v4.0 (free of charge updates) Full details are listed at the related catalog's page			

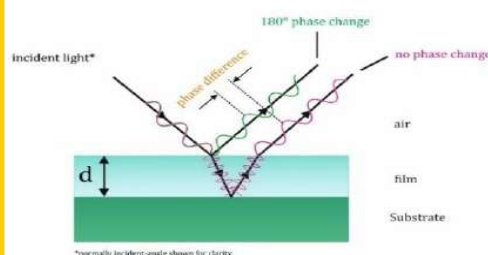
ACCESSORIES

Focusing module	Optical module attached on the reflection probe for <100um diameter spot size
Film/Cuvette kit	Transmission measurements of films or liquids in standard cuvettes
Contact probe	Thickness & optical measurements of coatings in the field. Ideal for curved surfaces
Microscope	Microscope-based reflectance and thickness measurements with high lateral resolution
Manual X-Y stage	Manual X-Y stage for measurements over an area of 25x25mm /100x100mm / 200x200mm



PRINCIPLE OF OPERATION

White Light Reflectance Spectroscopy (WLRS) measures the amount of light reflected from a film or a multilayer stack over a spectral range, with the incident light normal (perpendicular) to the sample surface. The measured reflectance spectrum, produced by interference from the individual interfaces is being used to determine the thickness, optical constants (n & k), etc. of free-standing and supported (on transparent or partially/fully reflective substrates) stack of films.



* Specifications are subject to change without any notice; ** Thickness range depends on the spectral range and refers to a single layer with refractive index ~1.5 over Si or similar substrate
 ** Measurements compared with a calibrated spectroscopic ellipsometer and XRD, Average of standard deviation of mean value over 15 days. Sample: 1micron SiO₂ on Si wafer, Standard deviation of 100 thickness measurements. Sample: 1micron SiO₂ on Si wafer, 2*Standard-Deviation of daily average over 15 days. Sample: 1micron SiO₂ on Si wafer.

Micro-Spot Tools

FR-uProbe: Extend your microscope in a powerful film thickness measurement tool

FR-uProbe: the stand-alone tool for applications that require spot size as small as very few microns, e.g. micro-patterned surfaces, samples that exhibit a high level of scattering light and numerous others.

With FR-uProbe, local film thickness, optical constants, reflectance, transmission, and absorbance measurements in Vis/NIR, is **just a matter of a click.**

APPLICATIONS

- **Univ. & Research labs**
- **Semiconductors** (Oxides, Nitrides, Si, Resists, etc.)
- **MEMS devices** (Photoresists, Si membranes, etc.)
- **LED**
- **Data Storage**
- **Anodization**
- **Hard/Soft coatings on curved substrates**
- **Polymer coatings, adhesives, etc.**
- **Biomedical** (parylene, balloon wall thickness, etc.)

And many more...



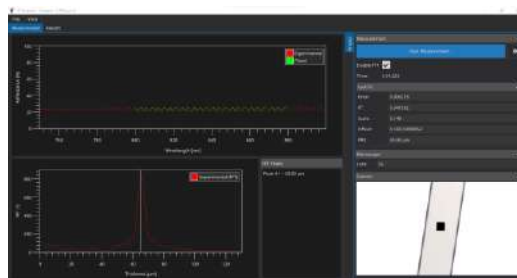
FR-uProbe, simply attaches to the C-mount adapter of most commercially available optical microscopes (reflectance and / or transmittance) and provides:

- Real-time spectroscopic measurements at the wavelength range supported by the microscope
- Film thickness, optical properties, non-uniformity measurements
- Imaging with an integrated, USB connected and high-resolution & quality color camera
- Unaffected performance of the microscope itself

The spot size, the area from which the reflectance or transmittance signal is collected is defined by the aperture size and objective lens magnification and can be as small as 2 μ m.

FEATURES

- Single-click analysis (no need for initial guess)
- Dynamic measurements
- Measurement of n & k, color
- Multiple installations for off-line analysis
- Free of-charge Software update



SPECIFICATIONS*

Microscope

Spectral Range (depends on light source)

Pixels

Thickness range (5X objective lens)

Thickness range (10X objective lens)

Thickness range (20X objective lens)

Thickness range (40X objective lens)

Refractive Index calculation

Thickness Accuracy**

Thickness Precision**

Thickness stability**

Camera

Working distance

Internal Light source

Microscope's Light source

Wavelength resolution

A/D converter

FR-API

Power

Dimensions

Material Database

SW Characteristics

FR-uProbe

400nm – 1000nm

3648

15nm – 90µm

15nm – 80µm

15nm – 50µm

15nm – 25µm

✓ /min. thickness: 100nm

0.2% or 2nm

0.02nm

0.05nm

2M/5M pixels

FR-uProbe-LC

Reflectance/Transmittance trinocular

400nm – 1000nm

1024

20nm-50µm

20nm – 45µm

20nm – 30µm

20nm – 15µm

✓ /min. thickness: 100nm

0.3% or 3nm

0.05nm

0.07nm

2M/5M pixels

Defined by objective lens

Stabilized tungsten halogen, MTBF > 3000h with filter holder (OPTIONAL)

Microscope's light source (tungsten / LED)

0.8nm

1.5nm

16 bit

YES

NO

USB – (external light source), 110V/230V, 50-60Hz, 20W (internal light source)

220x160x95mm (Spectrometer) & 227x107x51mm (microscope attachment)

> 800 different materials

FR-Monitor v4.0 (free of charge updates) Full details at related catalog's page

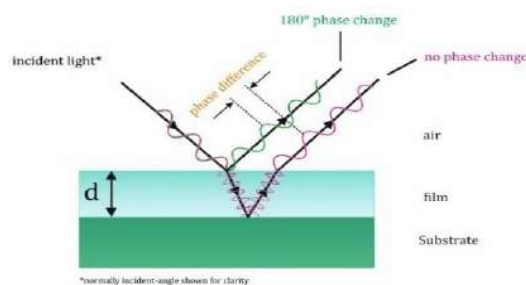
The measurement area (the area from which the reflectance or transmittance signal is collected) is relative to the microscope's objective lens and the FR-uProbe's aperture size. Standard apertures sizes are: 500µm, 250µm, 100µm. Apertures with size 150µm and 50µm are also available upon request.

Objective Lens	Spot Size (µm)		
	500 µm Aperture	250 µm Aperture	100 µm Aperture
5x	100 µm	50 µm	20 µm
10x	50 µm	25 µm	10 µm
20x	25 µm	14 µm	5 µm
50x	10 µm	5 µm	2 µm

PRINCIPLE OF OPERATION

White Light Reflectance Spectroscopy (WLRS) measures the amount of light reflected from a film or a multilayer stack over a spectral range, with the incident light normal (perpendicular) to the sample surface.

The measured reflectance spectrum, produced by interference from the individual interfaces is being used to determine the thickness, optical constants (n & k), etc. of free-standing and supported (on transparent or partially/fully reflective substrates) stack of films.



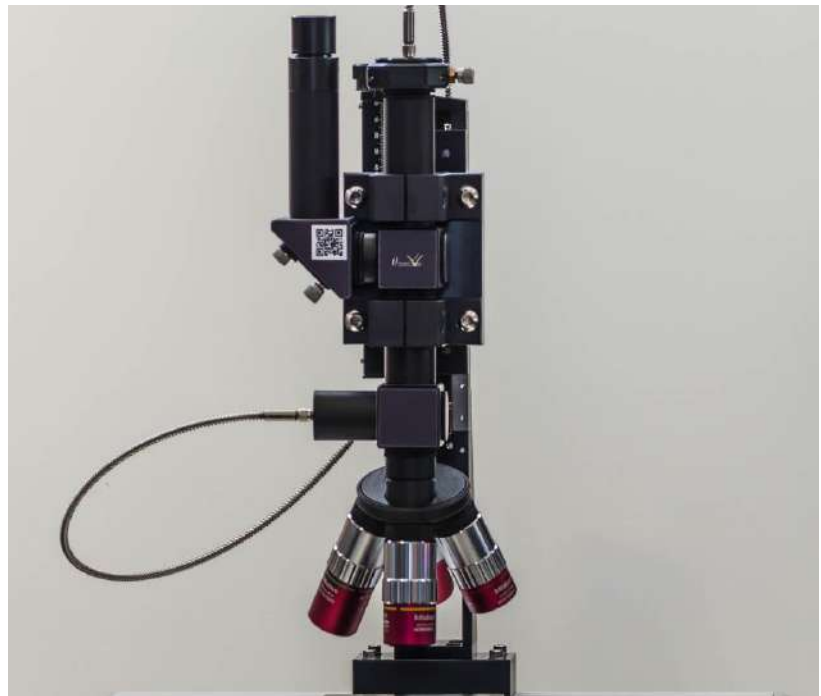
* Specifications are subject to change without any notice; ** Thickness range depends on the spectral range and refers to a single layer with refractive index ~1.5 over Si or similar substrate ** Measurements compared with NIST wafers and calibrated spectroscopic ellipsometer and XRD, Average of standard deviation of mean value over 15 days. Sample: 1micron SiO₂ on Si wafer, Standard deviation of 100 thickness measurements. Sample: 1micron SiO₂ on Si wafer, 2*Standard-Deviation of daily average over 15 days. Sample: 1micron SiO₂ on Si wafer.

FR-Mic: Film characterization in the μm lateral scale

With **FR-Mic**, local measurement of film thickness, optical constants, reflectance, transmission, and absorbance across any spectral regime within UV / VIS / NIR spectral range, is just a matter of a click. FR-Mic can be mounted either on FR-pRo units or over external manual or motorized stages when large surfaces need to be characterized.

APPLICATIONS

- **Univ. & Research labs**
- **Semiconductors** (Oxides, Nitrides, Si, Resists, etc.)
- **MEMS devices** (Photoresists, Si membranes, etc.)
- **LEDs, VCSELs**
- **Data Storage**
- **Anodization**
- **Hard/Soft coatings on curved substrates**
- **Polymer coatings, adhesives, etc.**
- **Biomedical** (parylene, balloon wall thickness, etc.)
- And many more...
(contact us with your requirements)



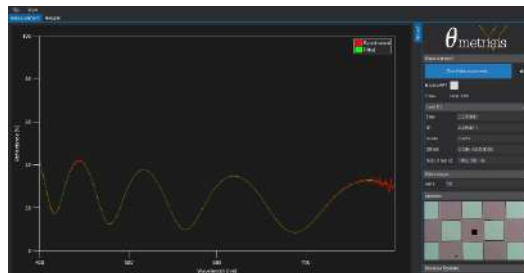
FR-Mic is the modular optical column for **fast & accurate** coating characterization applications that require **spot size as small as few micrometers**. Typical examples include (but not limited to): micro-patterned surfaces, rough surfaces and numerous others. It can be combined with a wide range of computer controlled XY and R θ stages, allowing the automated thickness & optical properties mapping of samples fast, easily and accurately.

FR-Mic provides:

- Real-time spectroscopic measurements
- Film thickness, optical properties, non-uniformity measurements, thickness mapping
- Imaging with an integrated, USB connected and high-quality color camera
- Numerous user-friendly functions e.g. Click2Move, Measurement scale.

FEATURES

- Single-click analysis (no need for initial guess)
- Dynamic measurements
- Measurement of n & k, color
- Multiple installations for off-line analysis
- Free of-charge Software update



SPECIFICATIONS*

Model	UV/VIS	UV/NIR -EXT	UV/NIR-HR	D UV/NIR	VIS/NIR	D VIS/NIR	NIR	NIR-N2	
Spectral Range (nm)	200 – 850	200 –1020	200-1100	200 – 1700	380 –1020	380 – 1700	900 – 1700	900 - 1050	
Spectrometer Pixels	3648	3648	2048	3648 & 512	3648	3648 & 512	512	3648	
Thickness range	5X- VIS/NIR	4nm – 60μm	4nm – 70μm	4nm – 90μm	4nm – 150μm	15nm – 90μm	15nm–150μm	100nm-150μm	4μm–1mm SiO ₂ 400μm Si***max
	10X-VIS/NIR 10X-UV/NIR*	4nm – 50μm	4nm – 60μm	4nm – 80μm	4nm – 130μm	15nm – 80μm	15nm–130μm	100nm–130μm	–
	15X- UV/NIR *	4nm – 40μm	4nm – 50μm	4nm – 50μm	4nm – 120μm	–	–	100nm-100μm	–
	20X- VIS/NIR 20X- UV/NIR *	4nm – 25μm	4nm – 30μm	4nm – 30μm	4nm – 50μm	15nm – 50μm	15nm – 60μm	100nm – 60μm	–
	40X- UV/NIR *	4nm – 4μm	4nm – 4μm	4nm – 5μm	4nm – 6μm	–	–	–	–
	50X- VIS/NIR	–	–	–	–	15nm – 7μm	15nm – 8μm	100nm – 8μm	–
Min. Thickness for n & k	50nm	50nm	50nm	50nm	100nm	100nm	500nm	–	
FR-API	YES	YES	NO	YES	YES	YES	NO	YES	
Thickness Accuracy **	0.2% or 1nm					0.2% or 2nm		3nm or 0.3%	
Thickness Precision **	0.02nm					0.02nm		<1nm	5nm
Thickness stability **	0.05nm					0.05nm		<1nm	5nm
Light Source (Not Included)	Balanced Deuterium & Halogen (internal), 2000h (MTBF)					Halogen (internal), 3000h (MTBF)			
Material Database	> 800 different materials								
SW Characteristics	FR-Monitor v4.0 (free of charge updates) Full details are listed at the related catalog's page								

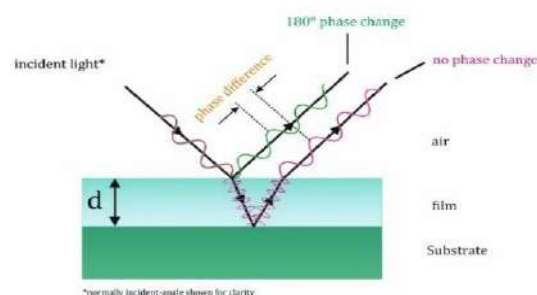
The measurement area (the area from which the reflectance or transmittance signal is collected) is relative to the objective lens and the FR-Mic's aperture size. Standard apertures sizes are: 500μm, 250μm, 100μm. Apertures with size 150μm and 50μm are also available upon request.

Objective Lens	Spot Size (μm)		
	500 μm Aperture	250 μm Aperture	100 μm Aperture
5x	100 μm	50 μm	20 μm
10x	50 μm	25 μm	10 μm
20x	25 μm	14 μm	5 μm
50x	10 μm	5 μm	2 μm

PRINCIPLE OF OPERATION

White Light Reflectance Spectroscopy (WLRs) measures the amount of light reflected from a film or a multilayer stack over a spectral range, with the incident light normal (perpendicular) to the sample surface.

The measured reflectance spectrum, produced by interference from the individual interfaces is being used to determine the thickness, optical constants (n & k), etc. of free-standing and supported (on transparent or partially/fully reflective substrates) stack of films.



* Specifications are subject to change without any notice; ** Thickness range depends on the spectral range and refers to a single layer with refractive index ~1.5 over Si or similar substrate
 ** Measurements compared with a calibrated spectroscopic ellipsometer and XRD, Average of standard deviation of mean value over 15 days. Sample: 1μmSiO₂ on Si, Standard deviation of 100 thickness measurements. Sample: 1μmSiO₂ on S, 2*Standard-Deviation of daily average over 15 days. Sample: 1micron SiO₂ on Si wafer. *** For Double Side Polished Si wafer

Wafer Tools

FR-Scanner AIO-R0150: Automated wafer mapping

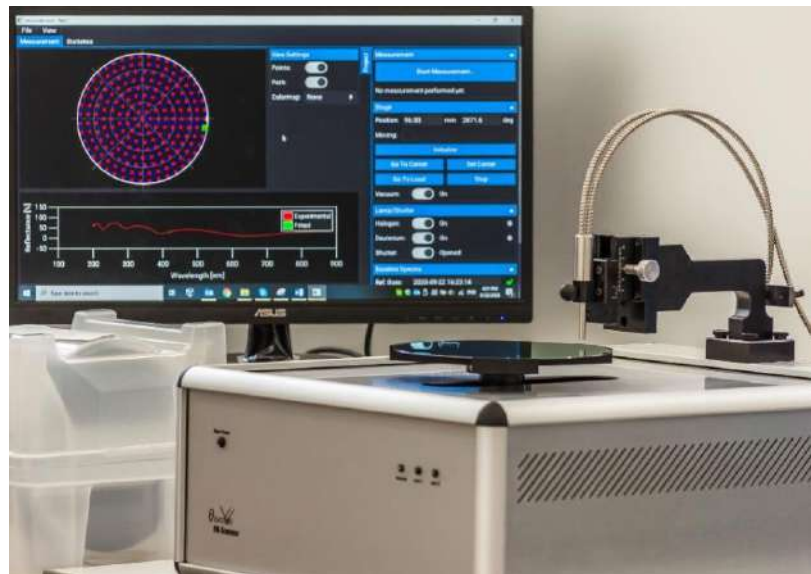
FR-Scanner AllInOne: the tool for automatic characterization of films and coatings on wafers, masks or other substrates.

FR-Scanner is the ideal tool for the fast, accurate and non-destructive mapping of film properties: thickness, refractive index, uniformity, color etc.

Wafers of any diameter (300mm max) and shape can be accommodated on the vacuum chuck.

APPLICATIONS

- **Semiconductor Manufacturing**
(Photoresists, dielectrics, poly- Si, a-Si, DLC, photonic multilayer structures)
- **PV Industry**
- **Univ. & Research labs**
- **Liquid Crystal Display**
- **Optical Coatings**
- **Polymers**
- **MEMS and MOEMS**
- **Substrates: transparent** (glass, quartz, etc.) **and semi-transparent**



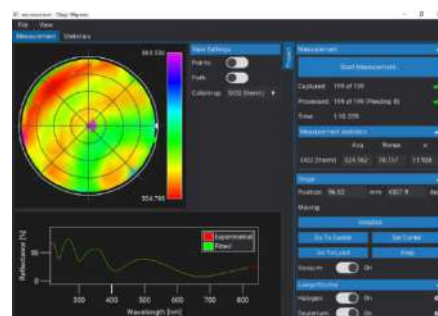
FR-Scanner-AIO-R0150 operates in Polar Coordinates with unparalleled speed and accuracy in both radius & angle. Accurate reflectance data with high repeatability are recorded, making FR-Scanner the ideal tool for at-line and on-line characterization of films on wafers / other substrates at processing facilities.

It is offered in a wide range of configurations for the characterization of films as thin as few nanometers and thick as several hundreds of microns and is accompanied with a dedicated S/W for daily routine use. FR-Scanner provides excellent performance in terms of accuracy, precision, reproducibility and long-term stability.

The FR-Scanner-AIO-R0150 platform is offered in a very wide range of implementations covering a wide spectral range (200-1700nm) and thickness range.

FEATURES

- Single-click analysis (no need for initial guess)
- Dynamic measurements
- Measurement of n & k, color
- Multiple installations for off-line analysis
- Free of-charge Software update



SPECIFICATIONS*

Model	UV/VIS	UV/NIR -EXT	UV/NIR-HR	D UV/NIR	VIS/NIR	D Vis/NIR	NIR	RED/NIR	NIR-N1	NIR-N2	NIR-N3	NIR-N4
WL Range -nm	200 – 850	200 –1000	190-1100	200 – 1700	380 –1020	380 – 1700	900 – 1700	600-850	850-1050	900 - 1050	1280-1350	1520-1580
Pixels	3648	3648	2048	3648 & 512	3648	3648 & 512	512	3648	3648	3648	512	512
Min Thick -SiO ₂	3nm	3nm	3nm	3nm	15nm	15nm	50nm	600nm	1μm	4μm	12μm	20μm
Max Thick SiO ₂	80μm	90μm	100μm	250μm	100μm	250μm	250μm	300μm	500μm	1mm	2mm	3mm
Max Thick -Si***									300μm***	400μm***	1mm***	1.3mm***
n&k -Min Thick			50nm		100nm	100nm	500nm			-	-	-
Thick. Accuracy **	1nm / 0.2%	1nm / 0.2%	1nm / 0.2%	1nm / 0.2%	1nm / 0.2%	2nm / 0.2%	3nm / 0.4%	25nm / 0.2%	50nm / 0.2%	50nm / 0.2%	50nm / 0.2%	50nm / 0.2%
Thick. Precision**			0.05nm		0.05nm	0.05nm	0.1nm	5nm		5nm	5nm	5nm
Thick. stability **			0.05nm		0.05nm	0.05nm	0.15nm	5nm		5nm	5nm	5nm
Light Source	Internal Deuterium & Halogen, 2000h (MTBF)						Halogen (internal), 3000h (MTBF)					
Wafer size	Wafers: 2in-3in-4in-6in-8in-300mm***											
Scanning Speed	120meas/min (8” wafer size)											
Spot size	Diameter of 350um (smaller spot size options are available upon request)											
R/Angle resolution	5μm/0.1o											
Dimensions -mm	600L x 460W x 350H											
Power	110V/230V, 50-60Hz, 300W											
Material Database	> 800 different materials											
SW Characteristics	FR-Monitor v4.0 (free of charge updates) Full details at the related catalog's page											

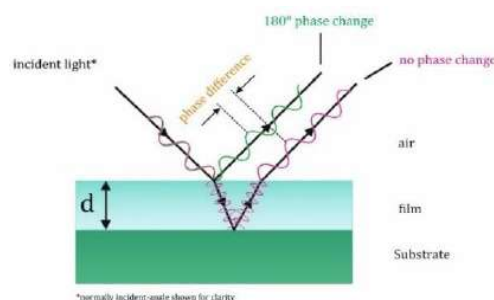
OPTIONS

R-axis:	200mm long linear axis for mapping of wafers with diameter up to 400mm.
Chucks:	Standard chucks (4in, 6in, 8in, 12in) and multi wafer chucks (any size up to 200mm, or any size up to 300mm), custom-designed chucks upon request
FR-Mic:	For characterization of patterned wafers with small spot-size

PRINCIPLE OF OPERATION

White Light Reflectance Spectroscopy (WLRS) measures the amount of light reflected from a film or a multilayer stack over a spectral range, with the incident light normal (perpendicular) to the sample surface.

The measured reflectance spectrum, produced by interference from the individual interfaces is being used to determine the thickness, optical constants (n & k), etc. of free-standing and supported (on transparent or partially/fully reflective substrates) stack of films.



Specifications are subject to change without any notice. True X-Y scanning is also possible through custom-made configuration ** Measurements compared with a calibrated spectroscopic ellipsometer and XRD, Average of standard deviation of mean value over 15 days. Sample: 1micron SiO₂ on Si wafer, Standard deviation of 100 thickness measurements. Sample: 1micron SiO₂ on Si wafer, 2*Standard-Deviation of daily average over 15 days. Sample: 1micron SiO₂ on Si wafer. *** For Double Side Polished Si wafers ****Stage for 450mm wafers is also available upon request.

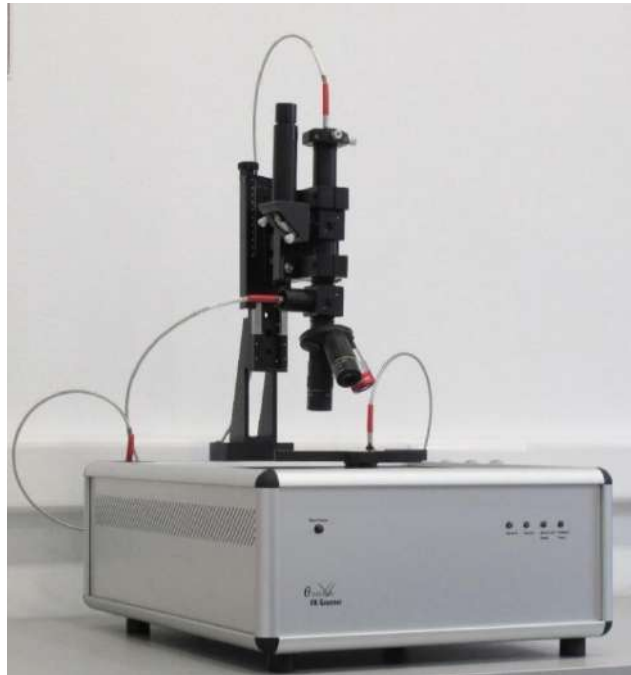
FR-Scanner AIO-Mic-Rθ150: Automated wafer mapping with μm lateral scale spot

FR-Scanner-AIO-Mic-Rθ150 is a holistic platform for the fully-automated in-depth characterization of patterned single and multilayer coatings on wafers. Wafers of any diameter (300mm max) and shape can be accommodated on the vacuum chuck.

The tool is offered in an endless range of optical configurations within the 200-1700nm spectral range.

APPLICATIONS

- **Semiconductors** (Oxides, Nitrides, Si, Resists, etc.)
- **MEMS devices** (Photoresists, Si membranes, etc.)
- **LEDs, VCSELs**
- **Data Storage**
- **Polymer coatings, adhesives, etc.**
- And many more...
(contact us with your requirements)



FR-Scanner-AIO-Mic-Rθ150 is the modular platform that integrates in one unit state-of-the-art optical, electronic, and mechanical modules for the characterization of patterned thin and thick films.

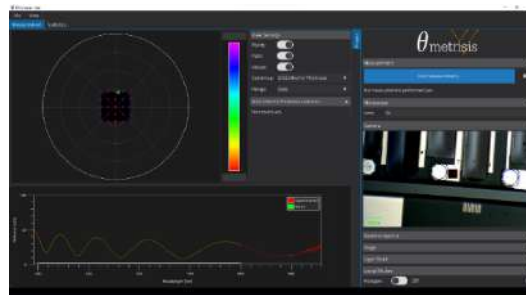
The wafer is mounted on a vacuum chuck and the characterization is performed by a powerful optical module with a **spot size as small as a few micrometers**. The motorized and with ultra-high precision & repeatability Rθ stage provides coverage of every point on a wafer with diameter up to 300mm.

FR-Scanner-AIO-Mic-Rθ150 provides:

- Real-time spectroscopic reflectance measurements
- Film thickness, optical properties, non-uniformity measurements, thickness mapping
- Imaging with integrated, and high-quality color camera
- Wide range of statistics for the parameters under characterization
- Semi-automatic pattern alignment capability for mapping of periodic small patterns
- Unique S/W features such as: Click2Move, Scale bar

FEATURES

- Single-click analysis (no need for initial guess)
- Dynamic measurements
- Optical parameters (n & k, color)
- Accurate Click to move operation
- Build-in alignment operation
- Multiple installations for off-line analysis



SPECIFICATIONS*

Model	UV/VIS	UV/NIR-EXT	UV/NIR-HR	D UV/NIR	VIS/NIR	D VIS/NIR	NIR	NIR-N2
Spectral Range (nm)	200 – 850	200 – 1000	200 – 1100	200 – 1700	380 – 1020	370 – 1700	900 – 1700	900 – 1050
Spectrometer Pixels	3648	3648	2048	3648 & 512	3648	3648 & 512	512	3648
Thickness range (SiO₂)	5X- VIS/NIR	4nm – 60μm	4nm – 70μm	4nm – 100μm	4nm – 150μm	15nm – 90μm	15nm – 150μm	100nm – 150μm
	10X- VIS/NIR	4nm – 50μm	4nm – 60μm	4nm – 80μm	4nm – 130μm	15nm – 80μm	15nm – 130μm	100nm – 130μm
	10X- UV/NIR*	4nm – 50μm	4nm – 60μm	4nm – 80μm	4nm – 130μm	15nm – 80μm	15nm – 130μm	100nm – 130μm
	15X- UV/NIR*	4nm – 40μm	4nm – 50μm	4nm – 50μm	4nm – 120μm	–	–	100nm – 100μm
	20X- VIS/NIR	4nm – 25μm	4nm – 30μm	4nm – 30μm	4nm – 50μm	15nm – 50μm	15nm – 60μm	100nm – 60μm
Min. Thickness for n & k	20X- UV/NIR *	4nm – 4μm	4nm – 4μm	4nm – 5μm	4nm – 6μm	–	–	–
	40X- UV/NIR*	–	–	–	–	–	–	–
	50X- VIS/NIR	–	–	–	–	15nm – 7μm	15nm – 8μm	100nm – 8μm
Thickness Accuracy **			50nm			100nm	100nm	500nm
Thickness Precision **			0.1% or 1nm			0.2% or 2nm		3nm or 0.3%
Thickness stability **			0.02nm			0.02nm		<1nm
Light Source			0.05nm			0.05nm		<1nm
R/Angle resolution			Deuterium & Halogen			Halogen (internal), 3000h (MTBF)		
Wafer size					5μm/0.1°			
Scanning Speed					2in-3in-4in-6in-8in-300mm			
Tool footprint / Weight					100meas/min (8" wafer size)			
Power					650x500mm / 45Kg			
Material Database					110V/230V, 50-60Hz, 350W			
SW Characteristics					> 800 different materials			

FR-Monitor v4.0 (free of charge updates) Full details at the related catalog's page

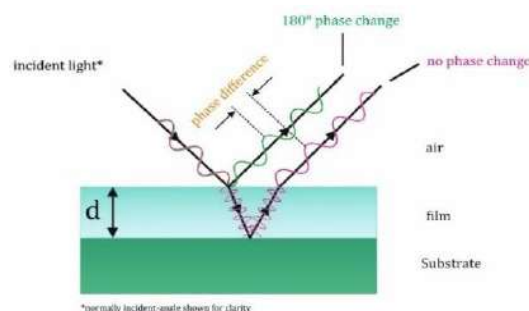
The spot size depends on the objective lens and the aperture size. Standard apertures are: 500μm, 250μm, 100μm (150μm and 50μm apertures are available upon request).

Objective Lens	Spot Size		
Magnification	500 μm Aperture	250 μm Aperture	100 μm Aperture
5x	100 μm	50 μm	20 μm
10x	50 μm	25 μm	10 μm
20x	25 μm	14 μm	5 μm
50x	10 μm	5 μm	2 μm

PRINCIPLE OF OPERATION

White Light Reflectance Spectroscopy (WLRs) measures the amount of light reflected from a film or a multilayer stack over a spectral range, with the incident light normal (perpendicular) to the sample surface.

The measured reflectance spectrum, produced by interference from the individual interfaces is being used to determine the thickness, optical constants (n & k), etc. of free-standing and supported (on transparent or partially/fully reflective substrates) stack of films.



Specifications are subject to change without any notice. ** Measurements compared with a calibrated spectroscopic ellipsometer and XRD, Average of standard deviation of mean value over 15 days. Sample: 1micron SiO₂ on Si wafer, Standard deviation of 100 thickness measurements. Sample: 1micron SiO₂ on Si wafer, 2*Standard-Deviation of daily average over 15 days. Sample: 1micron SiO₂ on Si wafer. *** For Double Side Polished Si wafers ****Stage for 450mm wafers is also available upon request.

FR-Scanner-AIO-Mic-XY200: Automated & Fast mapping of films in the micron lateral scale

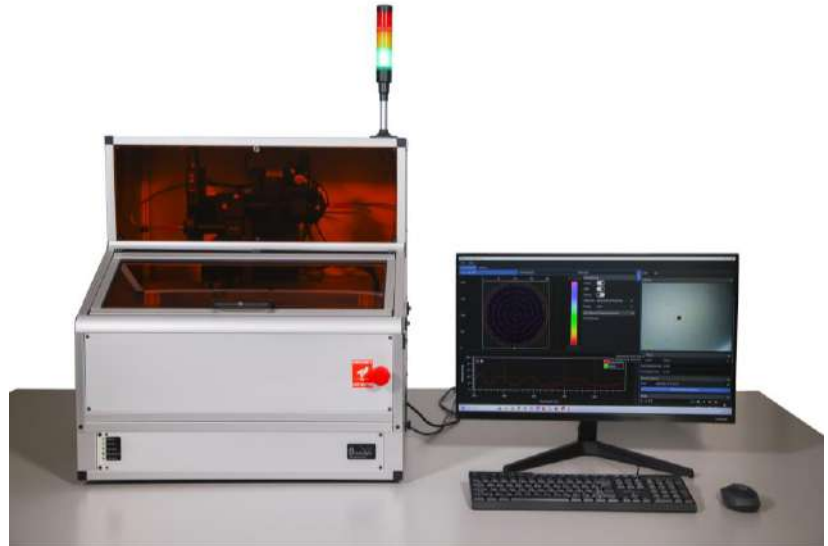
FR-Scanner-AIO-Mic-XY200

is a holistic platform for the fully-automated in-depth characterization of patterned single and multilayer coatings on wafers. It provides 200mm of travel along X and Y axes and is suitable for accurate measurements while the sample is secured on the stage through vacuum.

The tool is offered in an endless range of optical configurations within the 200-1700nm spectral range.

APPLICATIONS

- **Univ. & Research labs**
- **Semiconductors** (Oxides, Nitrides, Si, Resists, etc.)
- **MEMS devices** (Photoresists, Si membranes, etc.)
- **LEDs, VCSELs**
- **Data Storage**
- **Polymer coatings**, adhesives, etc.
- And many more...
(contact us with your requirements)



FR-Scanner-AllInOne-Mic-XY200 integrates under the same roof state-of-the-art optical, electronic, and mechanical modules for the accurate & precise characterization of patterned films. Typical examples include (but are not limited to): micro-patterned surfaces, rough surfaces, and numerous others.

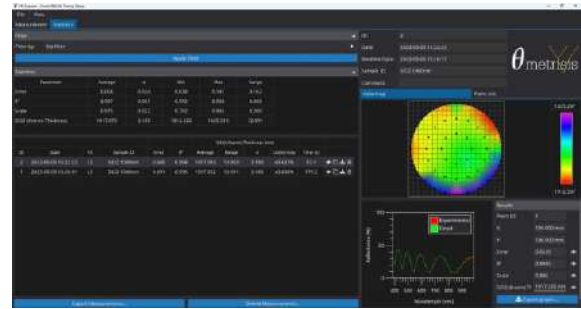
The wafer is placed on a vacuum chuck that supports any wafer size up to 200mm diameter and is equipped with reflectance standards. The characterization is performed by a powerful optical module with a **spot size as small as a few microns**. The motorized XY stage provides travel of 200mm on each axis with unprecedented speed, accuracy & repeatability.

FR-Scanner-AIO-Mic-XY200 provides:

- Real-time spectroscopic reflectance measurements
- Film thickness, optical properties, non-uniformity measurements, thickness mapping
- Imaging with integrated high-quality color camera
- Wide range of statistics for the parameters under characterization
- Semi-automatic pattern alignment capability for mapping of periodic small patterns
- Unique S/W features such as: Click2Move, Scale bar

FEATURES

- Single-click analysis (no need for initial guess)
- Dynamic measurements
- Optical parameters (n & k, color)
- Click2Move & Pattern alignment functions
- Multiple installations for off-line analysis
- Free of-charge Software update



SPECIFICATIONS*

Model	UV/VIS	UV/NIR-EXT	UV/NIR-HR	D UV/NIR	VIS/NIR	D VIS/NIR	NIR	NIR-N2	
Spectral Range (nm)	200 – 850	200 –1000	190-1100	200 – 1700	380 –1020	370 – 1700	900 – 1700	900 - 1050	
Spectrometer	CCD/CMOS image sensor, 16 bit A/D								
Spectrometer Pixels	3648	3648	2048	3648 & 512	3648	3648 & 512	512	3648	
Thickness range (SiO ₂)	5X- VIS/NIR	4nm – 60μm	4nm – 70μm	4nm – 80μm	4nm – 150μm	15nm – 90μm	15nm–150μm	100nm-150μm	4μm – 1mm
	10X-VIS/NIR 10X-UV/NIR*	4nm – 50μm	4nm – 60μm	4nm – 65μm	4nm – 130μm	15nm – 80μm	15nm–130μm	100nm–130μm	–
	15X- UV/NIR *	4nm – 40μm	4nm – 50μm	4nm – 50μm	4nm – 120μm	15nm – 60μm	–	100nm-100μm	–
	20X- VIS/NIR 20X- UV/NIR *	4nm – 25μm	4nm – 30μm	4nm – 30μm	4nm – 50μm	15nm – 50μm	15nm – 60μm	100nm – 60μm	–
	40X- UV/NIR *	4nm – 4μm	4nm – 4μm	4nm – 5μm	4nm – 6μm	–	–	–	–
	50X- VIS/NIR	–	–	–	–	15nm – 7μm	15nm – 8μm	100nm – 8μm	–
Min. Thickness for n & k	50nm			100nm		100nm	500nm	–	
Number of layers	Simultaneous measurement of 4 layers with adequate refractive index contrast								
Thickness Accuracy **	0.2% or 1nm				0.2% or 2nm		3nm or 0.3%		
Thickness Precision **	0.02nm				0.02nm		<1nm		
Thickness stability **	0.05nm				0.05nm		<1nm		
Light Source	Deuterium & Halogen (internal), 2000h (MTBF)				Halogen (internal)				
Microscope module	Microscope column with 2MP/5MP color image sensor with wide observation area								
Stage resolution	Better than 0.5μm								
Stage repeatability	±2μm (bi-directional)								
Absolute accuracy	±3μm								
Wafer size	2in-3in-4in-6in(150mm)-8in(200mm) and of any shape up to 200mm								
Scanning Speed	49meas/90sec (8’’ wafer size)								

OPTIONS

FR-AutoFocus	100mm long linear axis for autofocus with two modes of operation: Image focus (contrast) / Reflectance intensity
FR-FilterWheel	Motorized filter wheel module fully computer controlled with slots for 8 filters: filter dimensions: diameter of 1inch (clear aperture 23mm).
FR-AutoTurret	Motorized and computer-controlled turret that can accommodate 4 objective lenses: typical switching speed between lenses of 2.0-3.0sec.
Lenses	Long Working Distance VIS/NIR lenses: 5X, 10X, 20X, 40X, 50X Reflective UV/NIR lenses: 10X, 15X, 20X, 25X, 40X
Pump	Low-noise vacuum pump with 2.5L/min and degree of vacuum -60kPa.
Chucks	a) Single diameter wafer chucks (4in, 6in, 200mm) b) Photomask chuck (6in) with reference area c) Multiwafer chuck (100mm, 150mm, 200mm and irregular shape pieces) with reference and dark areas for automated baseline
Enclosure	Enclosure to house the tool, with interlock to activate the shutter or shut-down the lamp when the door to load the wafer opens

Specifications are subject to change without any notice. True X-Y scanning is also possible through custom-made configuration ** Measurements compared with a calibrated spectroscopic ellipsometer and XRD, Average of standard deviation of mean value over 15 days. Sample: 1micron SiO₂ on Si wafer, Standard deviation of 100 thickness measurements. Sample: 1micron SiO₂ on Si wafer, 2*Standard-Deviation of daily average over 15 days. Sample: 1micron SiO₂ on Si wafer. *** For Double Side Polished Si wafers ***Stage for 450mm wafers is also available upon request.

The measurement area (the area from which the reflectance signal is collected) is relative to the objective lens and the aperture size. Standard aperture sizes are: 500 μ m (square), 250 μ m (square), 150 μ m (square), 100 μ m (square), with the 250 μ m be the default one.

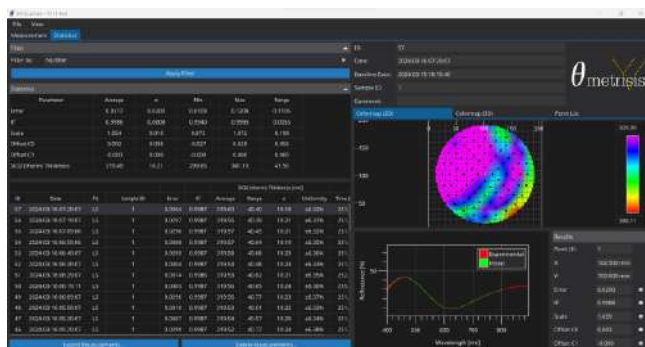
Additional aperture size upon request is: 50 μ m (square)

Objective Lens		Spot Size			
Magnification	WD (mm)	500 μ m Aperture	250 μ m Aperture (std)	150 μ m Aperture	100 μ m Aperture
5x	45	100 μ m	50 μ m	30 μ m	20 μ m
10x	34	50 μ m	25 μ m	15 μ m	10 μ m
20x	31	25 μ m	14 μ m	8 μ m	5 μ m
50x	20	10 μ m	5 μ m	3 μ m	2 μ m

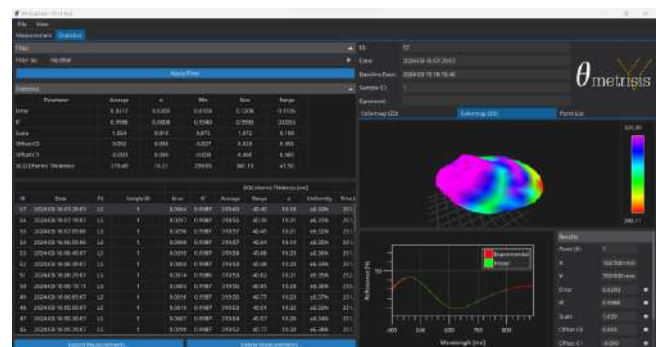
Power Requirements
Tool dimensions /
Material Database
SW Characteristics

Single-phase 96-230V, 5A@100V, 2A@220V
 800(W) x 600 (D) x 850mm (H) / 90Kg
 > 800 different materials

FR-Monitor v4.0 (free of charge updates) Full details at the related catalog's page



2D thickness map

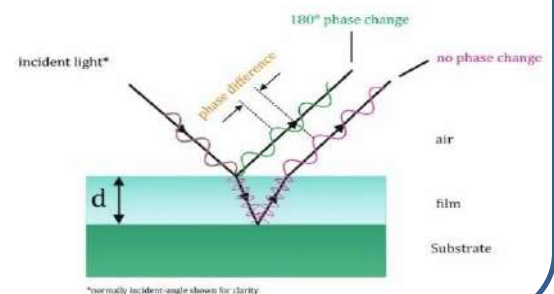


3D thickness map

PRINCIPLE OF OPERATION

White Light Reflectance Spectroscopy (WLRs) measures the amount of light reflected from a film or a multilayer stack over a spectral range, with the incident light normal (perpendicular) to the sample surface.

The measured reflectance spectrum, produced by interference from the individual interfaces is being used to determine the thickness, optical constants (n & k), etc. of free-standing and supported (on transparent or partially/fully reflective substrates) stack of films.



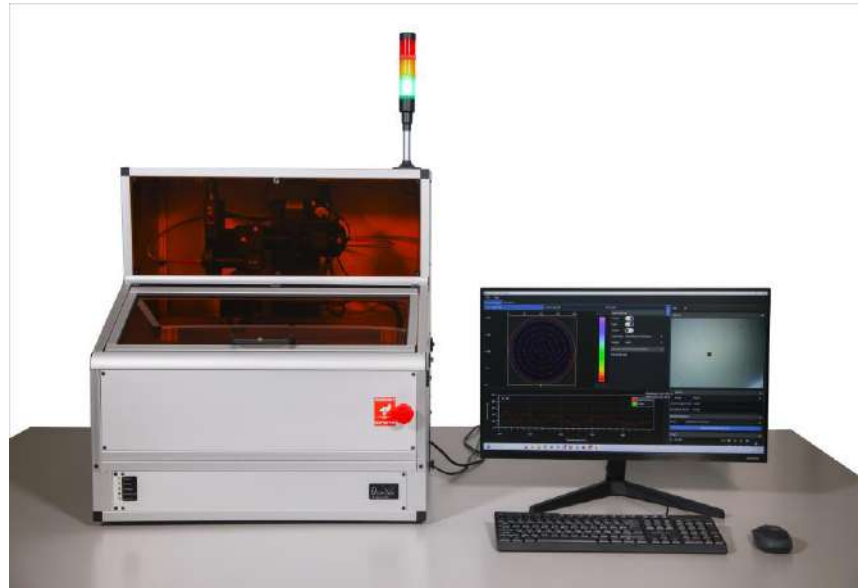
FR-Scanner-AIO-Mic-XY300: Automated & Fast mapping of films in the micron lateral scale

FR-Scanner-AIO-Mic-XY300

is a holistic platform for the fully-automated in-depth characterization of patterned single and multilayer coatings on wafers. It provides true 300mm of travel along X and Y axes and is suitable for accurate measurements while the sample is secured on the stage through vacuum. The tool is offered in a wide range of optical configurations within the 200-1700nm spectral range.

APPLICATIONS

- **Semiconductors** (Oxides, Nitrides, Si, Resists, etc.)
- **Wafer thickness**
- **MEMS devices** (solar-cells, a-Si membranes, etc.)
- **Univ. & Research labs**
- **Liquid Crystal displays**
- **Optical coatings** (e.g. medical devices)
- **Polymer coatings**, adhesives, etc.
- And many more...
(contact us with your requirements)



FR-Scanner-AllInOne-Mic-XY300 integrates under the same roof state-of-the-art optical, electronic, and mechanical modules for the accurate & precise characterization of un-patterned and patterned films (e.g. micro-patterned surfaces, rough surfaces, etc.).

The wafer is placed on a vacuum chuck (wafer size with $\leq 300\text{mm}$ diameter) and equipped with reflectance standards. The characterization is performed by a powerful optical module with a **spot size as small as a few μm** . The motorized XY stage provides 300mm travel on each axis with unprecedented speed, accuracy & repeatability.

FR-Scanner-AIO-Mic-XY300 provides:

- Real-time spectroscopic reflectance measurements
- Film thickness, optical properties, non-uniformity measurements, thickness mapping
- Imaging with an integrated, USB-connected, and high-quality color camera
- Wide range of statistics for the parameters under characterization
- Semi-automatic pattern alignment capability for mapping of periodic small patterns
- Unique S/W features such as: Click2Move, Scale bar

FEATURES

- Single-click analysis (no need for initial guess)
- Dynamic measurements
- Measurement of optical parameters (n & k, color)
- Click2Move & Pattern alignment functions
- History and Multiple installations for off-line analysis
- Free of-charge Software update

SPECIFICATIONS*

Model	UV/VIS	UV/NIR-EX	UV/NIR-HR	D UV/NIR	VIS/NIR	D VIS/NIR	NIR	NIR-N2	NIR-N3	
Spectral Range (nm)	200 – 850	200 – 1000	200-1100	200 – 1700	370 – 1020	370 – 1700	900 – 1700	900 - 1050	1280-1350	
Spectrometer	CCD image sensor									
Spectrometer Pixels	3648	3648	2048	3648 & 512	3648	3648 & 512	512	3648	512	
Thickness range (SiO ₂)	5X- VIS/NIR	4nm – 60μm	4nm – 70μm	4nm – 100μm	4nm – 150μm	15nm – 100μm	15nm–150μm	100nm–150μm	4μm – 1mm	10μm – 2mm
	10X-VIS/NIR 10X-UV/NIR*	4nm – 50μm	4nm – 60μm	4nm – 80μm	4nm – 130μm	10nm – 80μm	15nm–130μm	100nm–130μm	–	10μm – 2mm
	15X- UV/NIR *	4nm – 40μm	4nm – 50μm	4nm – 50μm	4nm – 120μm	–	–	100nm–100μm	–	
	20X- VIS/NIR 20X- UV/NIR *	4nm – 25μm	4nm – 30μm	4nm – 30μm	4nm – 50μm	10nm – 50μm	15nm – 60μm	100nm – 60μm	–	12μm – 1.9mm
	40X- UV/NIR *	4nm – 4μm	4nm – 4μm	4nm – 5μm	4nm – 6μm	–	–	–	–	
	50X- VIS/NIR	–	–	–	–	10nm – 7μm	15nm – 8μm	100nm – 8μm	–	
Thickness range (Si, DSP)	5X								2-450μm	7μm-1mm
	10X									7μm-1mm
	20X									7μm-0.9mm
Min. Thickness for n & k	50nm	50nm	50nm	50nm	100nm	100nm	500nm	–		
Number of layers	Simultaneous measurement of 5 layers with adequate refractive index contrast									
Thickness Accuracy **	0.1% or 1nm				0.2% or 2nm		3nm or 0.3%		0.4%	
Thickness Precision **	0.02nm				0.02nm		<1nm		5nm	
Thickness stability **	0.05nm				0.05nm		<1nm		5nm	
Light Source	Deuterium & Halogen (internal), 2000h (MTBF) with computer-controlled shutter				Halogen, 3000h MTBF (internal) with computer-controlled shutter			SLED MTBF>150000h, computer-control shutter		
Microscope module	Microscope column with 2MP/5MP color image sensor with wide observation area									
Stage	Resolution: Better than 0.5μm, Repeatability: ±2μm (bi-directional) Accuracy: ±2μm									
Wafer size	2in-3in-4in-6in(150mm)-8in(200mm) – 12in(300mm) and of any shape up to 300mm, wafer placement repeatability <0.5mm									
Scanning Speed	49meas/90sec (8" wafer size)									

OPTIONS

FR-AutoFocus

100mm long linear axis for autofocus with two modes of operation: Image focus (contrast) / Reflectance intensity

Rotation Module

Motorized stage providing very high resolution & accuracy

FR-FilterWheel

Motorized filter wheel module fully computer controlled with slots for 12 filters: filter dimensions: diameter of 0.5inch, up to 6 filters (1inch)

FR-AutoTurret

Motorized and computer-controlled turret that can accommodate 4 objective lenses: typical switching speed between lenses of 1.0-3.0sec.

Lenses

Long Working Distance VIS/NIR lenses: 5X, 10X, 20X, 40X, 50X

Reflective UV/NIR lenses: 10X, 15X, 25X, 40X

Pump

Low-noise vacuum pump with 2.5L/min and degree of vacuum -60kPa.

Chucks

a) Photomask chuck (6in) with reference area c) Multi-wafer chuck (100-300mm and irregular shape pieces) with reference and dark areas for automated baseline

Enclosure

Enclosure to house the tool, with interlock to activate the shutter when the door to load the wafer opens

Specifications are subject to change without any notice. True X-Y scanning is also possible through custom-made configuration ** Measurements compared with a calibrated spectroscopic ellipsometer and XRD, Average of standard deviation of mean value over 15 days. Sample: 1micron SiO₂ on Si wafer, Standard deviation of 100 thickness measurements. Sample: 1micron SiO₂ on Si wafer, 2*Standard-Deviation of daily average over 15 days. Sample: 1micron SiO₂ on Si wafer. *** For Double Side Polished Si wafers ****Stage for 450mm wafers is also available upon request.

The measurement area (the area from which the reflectance signal is collected) is relative to the objective lens and the aperture size. Standard aperture sizes are: 500μm (square), 250μm (square), 150μm (square), 100μm (square), with the 250μm be the default one.

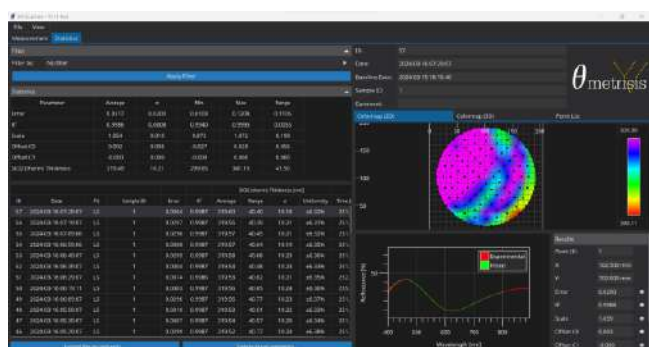
Additional aperture size upon request is: 50μm (square)

Objective Lens		Spot Size			
Magnification	WD (mm)	500 μm Aperture	250 μm Aperture (std)	150 μm Aperture	100 μm Aperture
5x	45	100 μm	50 μm	30 μm	20 μm
10x	34	50 μm	25 μm	15 μm	10 μm
20x	31	25 μm	14 μm	8 μm	5 μm
50x	20	10 μm	5 μm	3 μm	2 μm

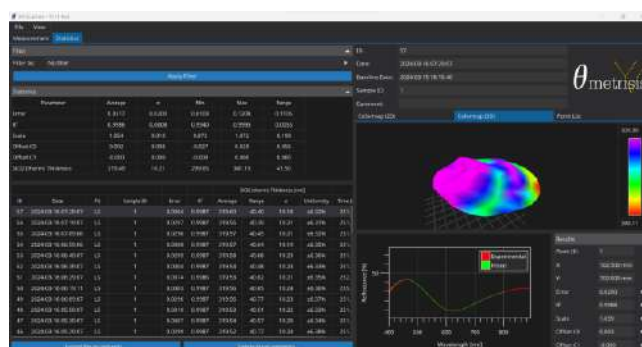
Graphs
File Formats
Software Language
Environmental
Vacuum
Power Requirements
Tool dimensions /
Material Database
SW Characteristics

2D thickness maps, 3D thickness maps
 TXT, CSV,
 English, Simplified Chinese, Japanese, Korean
 Temperature: 15-30°C, Relative Humidity: 35%-65%
 -60kPa -100kPa
 Single-phase 96-230V, 5A@100V, 2A@220V
 900(W) x 800 (D) x 1000mm (H) / 120Kg
 > 800 different materials

FR-Monitor v4.0 (free of charge updates) Full details at the related catalog's page



2D thickness map

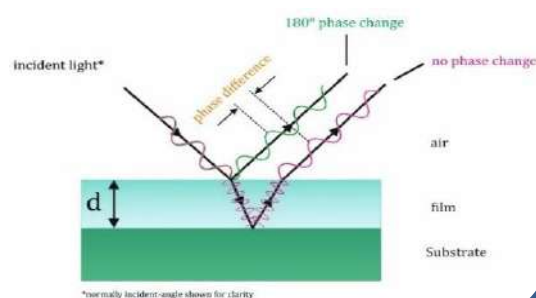


3D thickness map

PRINCIPLE OF OPERATION

White Light Reflectance Spectroscopy (WLRs) measures the amount of light reflected from a film or a multilayer stack over a spectral range, with the incident light normal (perpendicular) to the sample surface.

The measured reflectance spectrum, produced by interference from the individual interfaces is being used to determine the thickness, optical constants (n & k), etc. of free-standing and supported (on transparent or partially/fully reflective substrates) stack of films.



*normally incident-angle shows for clarity

InLine Tools

FR-InLine: Accurate InLine thickness measurement

FR-InLine is a modular & expandable platform for the In-line non-contact characterization of coatings in the **3nm-1mm** thickness range.

FR-InLine can provide real-time determination of several parameters such as: reflectance & transmittance spectra, thickness, colour, in a wide range of diverse application settings.

The module comes with dedicated S/W that can be executed in standard Windows 10/11.

Applications

- **Transparent and semi-transparent coatings**
- **Coatings on glasses**
- **Food industry**
- **Packaging**
- **Adhesives**
- **Flexible Electronics & Displays**
- **Other Industrial sites**

...

(Contact us with your



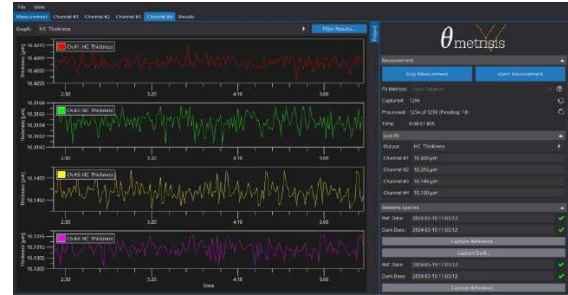
FR-InLine is available in both half-width (for up to 4-channels) and full-width (for up to 8 channels) 3U rack-mount chassis and characterize the coatings of interest in real-time. The FR-InLine offers the option for external triggering, through standard I/O, for start/stop/reset functions. The measurement data are immediately available for usage by other software for further tuning of the production process. The module is easily installed by end-user's engineers.

FR-InLine is accompanied with several accessories, such as:

- **TCP/IP** communication
- **Reflection probes and fibers** of any length and configuration to support any particular need
- **Optical modules (e.g. focusing lenses, kinematic holders)** to assist the mounting of the probes over the production line

FEATURES

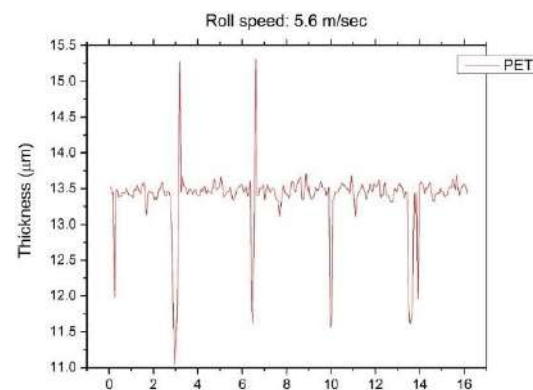
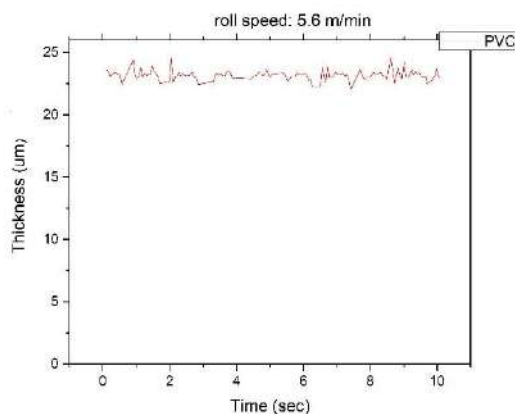
- Single-click analysis (no need for initial guess)
- Dynamic measurements
- Measurement of n & k, color
- Save images & videos for presentations
- Free of-charge Software update



MAXIMIZE PROCESS UPTIME & PRODUCT QUALITY MINIMIZE RAW MATERIAL CONSUMPTION & COST

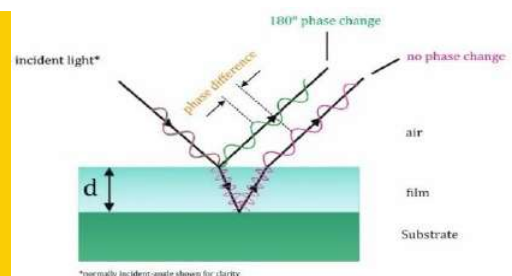
SPECIFICATIONS (STANDARD CONFIGURATIONS)

Model	UV/VIS	UV/NIR -EXT	VIS/NIR	NIR	NIR-N1
WL Range -nm	200 – 850	200 –1020	370 –1020	900 – 1700	850-1050
Pixels	3648	3648	3648	512	3648
Thickness Range	3nm-80um	3nm-90um	15nm-90um	200um	1um-400um
n&k -Min. Thickness	50nm	50nm	100nm	500nm	
Thick. Accuracy **	1nm / 0.2%	1nm / 0.2%	1nm / 0.2%	3nm / 0.4%	50nm / 0.2%
Thick. Precision**	0.02nm	0.02nm	0.02nm	0.1nm	
Thick. stability**	0.05nm	0.05nm	0.05nm	0.15nm	
Light Source	External Deuterium & Halogen, 2000h		Halogen (internal) 3000h (MTBF)		
Integration Time	5msec (min)		5msec (min)		
Spot size	Diameter of 350um (smaller spot size options are available upon request)				
Material Database	> 700 different materials				
Connectivity	USB or TCP/IP				
Power	100-240V 50-60Hz				



PRINCIPLE OF OPERATION

White Light Reflectance Spectroscopy (WLRS) measures the amount of light reflected from a film or a multilayer stack over a spectral range, with the incident light normal (perpendicular) to the sample surface. The measured reflectance spectrum, produced by interference from the individual interfaces is being used to determine the thickness, optical constants (n & k), etc. of free-standing and supported (on transparent or partially/fully reflective substrates) stack of films.



* Specifications are subject to change without any notice; ** Thickness range depends on the spectral range and refers to a single layer with refractive index ~1.5 over Si or similar substrate ** Measurements compared with a calibrated spectroscopic ellipsometer and XRD, Average of standard deviation of mean value over 15 days. Sample: 1micron SiO₂ on Si wafer, Standard deviation of 100 thickness measurements. Sample: 1micron SiO₂ on Si wafer, 2*Standard-Deviation of daily average over 15 days. Sample: 1micron SiO₂ on Si wafer.

Cassette Tools

FR-CasScan: Automated Thin-film Thickness Mapping with Cassette Loader



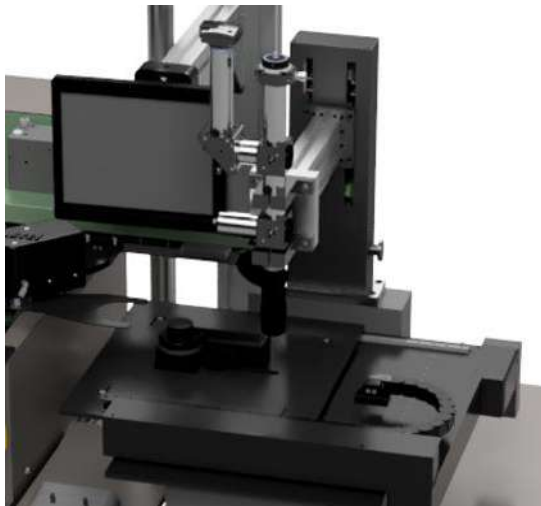
FR-CasScan is a radical & holistic wafer characterization system at production environments. FR-CasScan provides fully automated characterization of films on wafers along with a robust Cassette Loader.

FR-CasScan is equipped with advanced features such as: pre-aligner, high resolution and repeatability XY stage with 200mm travel on each axis, powerful UV/VIS/NIR autofocus microscope, high resolution spectrometer and numerous accessories (OCR, SECS/GEM, ...)

Applications

- **Semiconductor fabrication**
- **University & Research labs**
- **Resist characterization**
- **Dielectric characterizations**
- **Hardcoats, Anodization**
- **Optical Coatings**
- **And many more...**

(Contact us with your requirements)



With **FR-CasScan**, the accurate, fast and detailed characterization of ultra-thin, thin, thick & very-thick films on wafers is just a click away. The **very low Total Cost of Ownership system** is designed to handle heavy loads (even bonded wafers) without maintenance.

The **cassette loading unit** automatically pre-align and load wafers on the microscope's stage. The unit offers high speed, safe and smooth wafer handling (wafer thickness down to 200 μ m) and automatic wafer size detection.



The **measurement unit** is equipped with fast and with high accuracy & repeatability motorized XY-stage capable to map wafers of any diameter up to 8in.

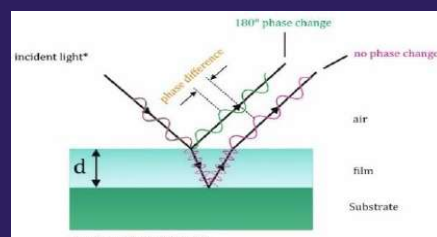
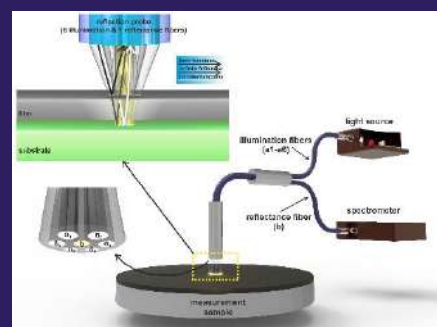
Automatic mapping mode, e.g. patterned wafers – in combination with automated wafer loading from cassette or manual loading – by means of point-to-point measurements through joystick or software is supported.

The system, comes with a powerful optical **autofocus microscope** with travel up to 80mm and several long working distance objective lenses that guarantee measurement with spot size < 4 μ m.

OPERATION PRINCIPLE

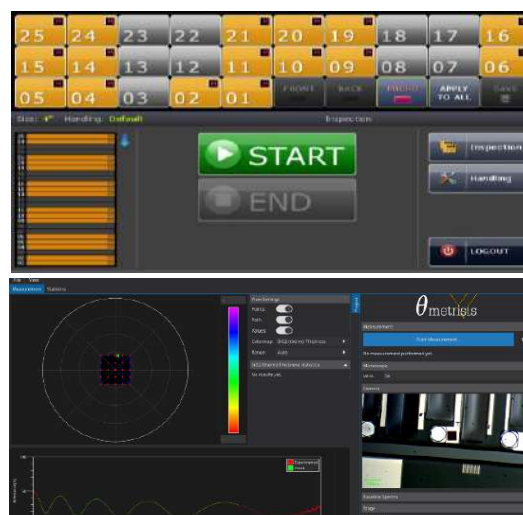
White Light Reflectance Spectroscopy (WLRS) measures the amount of light reflected from a film or a multilayer stack over a spectral range, with the incident light normal (perpendicular) to the sample surface.

The reflectance spectrum, produced by interference from the individual interfaces is being used to determine the thickness, optical constants (n & k), etc. of free-standing and supported (on transparent or partially/fully reflective substrates) stack of films.



FEATURES

- Auto wafer loading on the cassette recognition
- Auto notch detection and wafer pre-alignment
- Preparing next to load wafer during mapping (double grip loader)
- Auto pattern alignment
- Long working distance Auto focus microscope
- Single-click analysis (no need for initial guess)
- Dynamic measurements
- Measurement of reflectance, n & k, color
- Vast material library (>800 materials)
- 2D & 3D representation and statistical analysis
- Multiple installations for off-line analysis
- Free of-charge Software update



SPECIFICATIONS (STANDARD CONFIGURATIONS*)

Model	UV/VIS	UV/NIR-HR	D UV/NIR	VIS/NIR	D VIS/NIR	NIR	
Spectral Range (nm)	200 – 850	200-1100	200 – 1700	380 –1020	370 – 1700	900 – 1700	
Spectrometer Pixels	3648	2048	3648 & 512	3648	3648 & 512	512	
Thickness range	5X- VIS/NIR	4nm – 60μm	4nm – 110μm	4nm – 150μm	15nm – 90μm	15nm–150μm	100nm–150μm
	10X-VIS/NIR	4nm – 50μm	4nm – 80μm	4nm – 130μm	15nm – 80μm	15nm–130μm	100nm–130μm
	15X- UV/NIR	4nm – 40μm	4nm – 50μm	4nm – 120μm	–	–	100nm–100μm
	20X- VIS/NIR	4nm – 25μm	4nm – 30μm	4nm – 50μm	15nm – 50μm	15nm – 60μm	100nm – 60μm
	50X- VIS/NIR	–	15nm – 5μm	–	15nm – 7μm	15nm – 8μm	100nm – 8μm
Min. Thickness for n & k	50nm	50nm	50nm	100nm	100nm	500nm	
Thickness Accuracy *		0.2% or 1nm		0.2% or 2nm		3nm or 0.3%	
Thickness Precision **		0.02nm		0.02nm		<1nm	
Thickness stability **		0.05nm		0.05nm		<1nm	
Light Source	Balanced Deuterium & Halogen, 2000h (MTBF)			Halogen (internal), 3000h (MTBF)			
Pre-Aligner module	Included						
Wafer types	Si, LiNbO ₃ , GaAs, Ge, Al ₂ O ₃ , Glass, SiC, other semiconductor substrates						
Wafer Sizes	6in & 8in for automated handling & loading. 2in-8in for manual loading (irregular shape)						
Wafer Handling	High reliability carbon fiber end effector, Cassette laser mapping						
Material Database	> 800 different materials						
Dimensions & Weight	Dimensions: 150x79x150cm (LxWxH) main tool, 90x79x75cm (LxWxH) computer table. Total Weight:						
Clean Room compatibility	Class 10						
Power requirements	Power Requirements: 230±10% VAC, 50-60 Hz, 1KVA						
Dry air requirements	600 kPa, >100 NI/min (normal liter per min)						
Vacuum requirements	-75 to -90 kPa, >10 NI/min (normal liter per min)						
PC characteristics	AllInOne Win10/11, i7-12gen CPU, 16GB RAM, SSD disk, 23.8in monitor						

ACCESSORIES

OCR module	Optical module attached on the reflection probe for <100μm diameter spot size
Objective lenses	A wide range of objective lenses: VIS/NIR (5X, 10X, 20X, 50X) and UV/NIR (15X, 20X, 25X, 40X)
SECS II/GEM	SECS II/GEM interface with factory server

Specifications are subject to change without any notice; * The higher of; ** Thickness range depends on the spectral range and refers to a single layer with refractive index ~1.5 over Si or similar substrate ** Measurements compared with a calibrated spectroscopic ellipsometer and XRD, Average of standard deviation of mean value over 15 days. Sample: 1micron SiO₂ on Si wafer, Standard deviation of 100 thickness measurements. Sample: 1micron SiO₂ on Si wafer, 2*Standard-Deviation of daily average over 15 days. Sample: 1micron SiO₂ on Si wafer.

Software

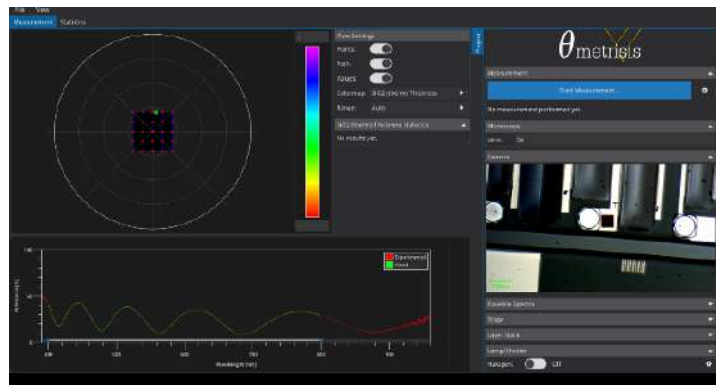
FR-Monitor: Control software for all FR-tools

FR-Monitor v4.0 is a powerful and dedicated software with modern interface for the control of all modules of FR-tools and the measurement of all parameters supported by FR-tools.

FR-Monitor is frequently upgraded (at least two times a year) and is loaded with a very wide materials database (>800 entries) to cover the needs of users with diverse needs.

CONTROL OF

- light sources (tungsten, deuterium-tungsten)
- spectrometers in UV-VIS-NIR spectral ranges
- Contact Probe
- FR-Mic module (autofocus, autoturret, autofilter included)
- RTheta and XY stages
- R-Thermal module



FR-Monitor is a powerful & user-friendly platform for the complete control of all FR-tools modules. The software employs the White Light Reflectance Spectroscopy method for fast and accurate measurement of a wide range of properties of films:

- Film thickness (single and multi-layer) by Levenberg-Marquart (LM), FFT, FFT+LM
- Refractive Index (n & k)
- Colour (L a b) parameters
- Film thickness uniformity
- Reflectance/Transmittance/Absorbance

in static and dynamic (InLine applications) modes.

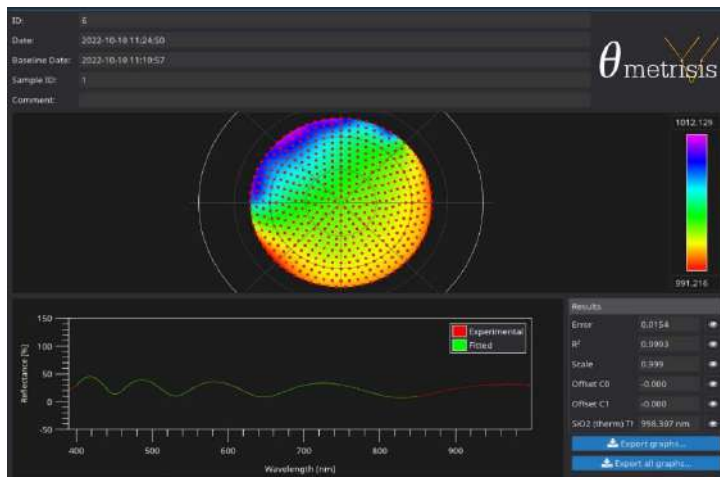
FR-Monitor empowers scientists and industry professionals with a robust tool for characterizing films and multilayer stacks, providing critical insights into their optical properties and supporting advancements in diverse fields such as materials science, optics, and nanotechnology.

FR-Monitor offers a wide range of functions to facilitate the user e.g: 2D/3D plots, Click2Move, Autofocus, Measurement bar, measurement statistics, Alarm functions, Film thickness correction, numerous models for the measurement of refractive index etc.

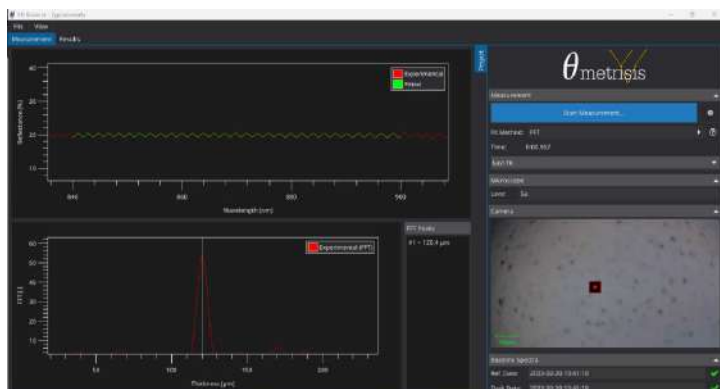
FR-Monitor v4.0 is executed in any PC running Windows 10/11 x64 operating system.

Minimum PC	PC Windows 10/11 64bit, i7-7+gen CPU, 16GB RAM, 512GB SSD disk, 23.8in monitor (1920x1080)
Results	Film thickness, Refractive Index, Color
Output format	Files: csv, txt, jpg Plots: 2D and 3D, histograms
Languages	English, Simplified Chinese, Japanese, Korean

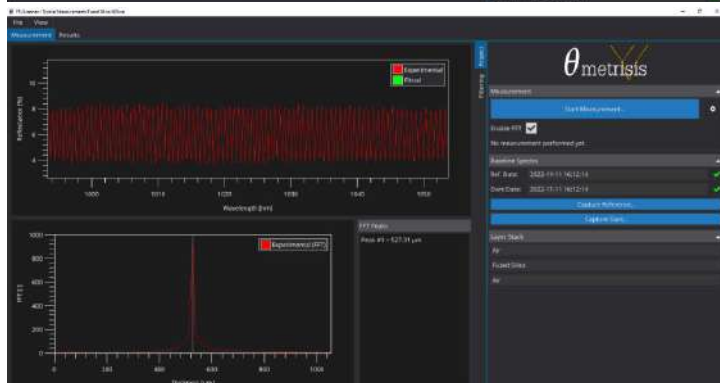
TYPICAL MEASUREMENTS



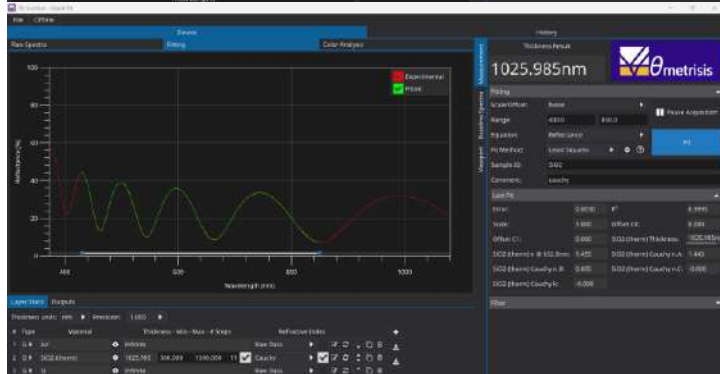
Thermal SiO₂ layer on Si wafer: Thickness mapping over an 8in Si wafer. Thickness measured by Levenberg-Marquart method



Measurement of resist thickness with FFT method and visualization of the area under characterization.



Measurement of Si wafer thickness with FFT method.



Calculation of Refractive Index of SiO₂ layer by using Cauchy model.

FR-InLine Monitor: Dedicated software for InLine applications

FR-InLine-Monitor is a dedicated Windows software for the control of FR-InLine tools. It supports up to 8 channels and is capable to measure in real time all channels and present measured values in related graphs.

FEATURES & APPS

- Control of FR- InLine platform
- Control of light source
- Control of up to 8 channels simultaneously
- Off-Line reanalysis of measurements
- Life-long Software update free-of-charge



FR-InLine-Monitor is a Windows software specifically crafted for continuous film thickness measurements in 24/7 In-Line scenarios, such as monitoring Roll-2-Roll processes or measuring film thickness on parts moving on belt conveyors.

It's engineered to handle up to 8 channels simultaneously and ensures extended operation without the need for frequent intervention. Users can conveniently access recorded data for offline analysis.

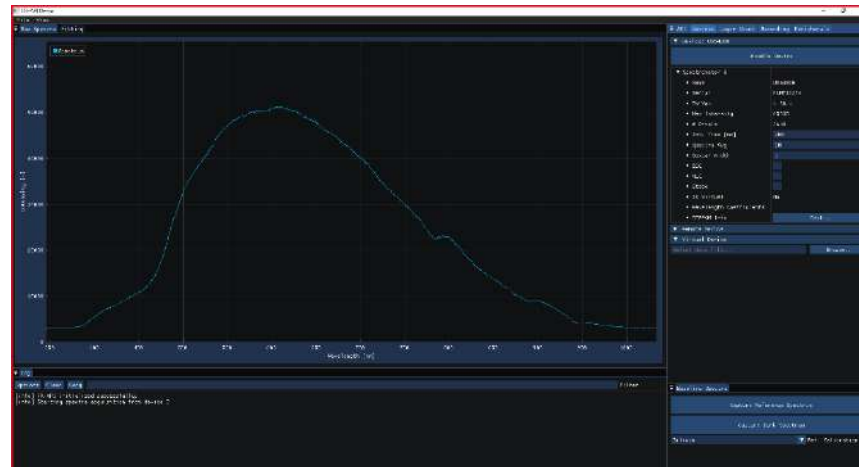
FR-InLine-Monitor is compatible with Windows 10 and 11, 64-bit systems.

FR-API: Application Programming Interface (API) for the control of FR-tools by other software

FR-API is a powerful API for the configuration and control of FR-tools by third party software.

It comes with FR-API demo, a Windows software that is open for debug for easier integration of FR-API in third-party software.

FR-API comes with virtual license and a set of reflectance spectra for fast off-line software development.



FR-API uses C++ internally and the publicly exposed functions are written in C. The API user (developer) can create wrapper functions in his/her language of choice in order to call FR-API functions. Use of complex C structures as function arguments has been kept to the minimum. Most API function arguments are POD types or pointers to POD types.

FR-API currently supports the Windows x64 (distributed as a DLL) platform

ThetaMetrisis currently provides wrappers for the following programming languages:

- C/C++: header (.h) + library (.lib) files

Currently FR-API supports the following functionalities/modules:

- Control of all light sources in FR-tools
- Control of all spectrometers in FR-tools
- Control of FR-Mic module
- Thickness measurements (Levenberg-Marquart, FFT)
- Refractive Index measurements (all models)
- Color characteristics

APPLICATIONS

- Control of FR-tools through other software
- Integration of FR-tools in larger systems
- FR-tool operation in in-line applications

FEATURES

- Control of light sources
- Control of all spectrometers in UV-VIS-NIR spectral ranges
- Control of FR-Mic module for micro-spot measurements

Accessories

FR-Thermal: Real-time Film Characterization during thermal treatment

FR-Thermal kit is an accessory for FR-pRo tools. It consists of a 5inch wide hot-plate fully controlled through FR-Monitor software.

The user can set the temperature, the heating rate, thermal cycle conditions etc. and monitor in real-time the thickness & optical properties (e.g. refractive index) evolution vs. time and temperature of thin/thick films (e.g. polymers, photoresists).

APPLICATIONS

- Characterization of polymers/photoresists
- Physicochemical properties
- Dynamic film thickness measurements
- Dynamic Reflectance measurements

FEATURES

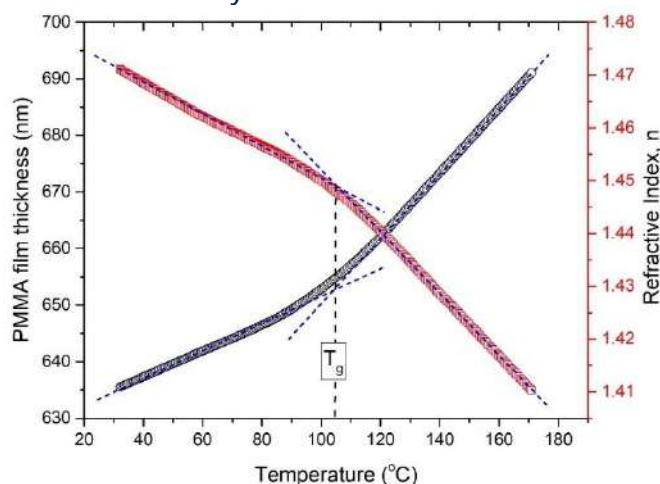
- Temp Range: room temp - 150°C*
- Manual/Auto control
- 5inch diameter heating area



By using FR-Thermal and the especially developed algorithms included in FR-Monitor, **physicochemical properties of the films**, such as:

- **glass transition temperature** (T_g^{film}), and
- **thermal degradation temperature of polymer films** (T_d^{film})

are measured for any film with thickness > 100nm.



Simultaneous monitoring of film thickness and optical properties changes of a PMMA film during heating.

The Glass Transition temperature (T_g^{film}) is 105°C

* The hot plate can be designed for temperatures up to 350°C.

** Specifications are subject to change without any notice.

FR-Liquid: In-situ Monitoring and Characterization of coatings immersed on liquids

FR-Liquid is an accessory for the real time monitoring, e.g. swelling or dissolution, of thickness and optical constants (n & k) of thin/thick films during processing in liquids (e.g. water, organic solvents).

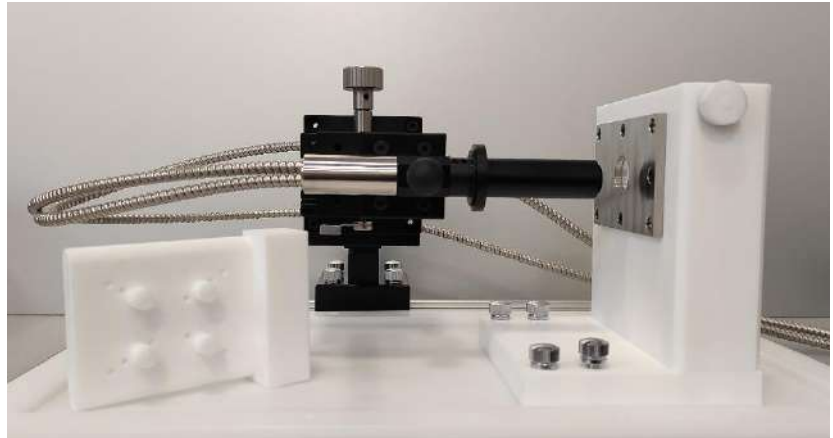
FR-Liquid can be used with any FR-pRo and FR-ES tool and at any spectral range thanks to its quartz optical port.

APPLICATIONS

- In-Situ Measurements
- Materials Characterization
- Polymers/Photoresists Characterization
- HardCoats
- Semiconductor
- Non Metal films

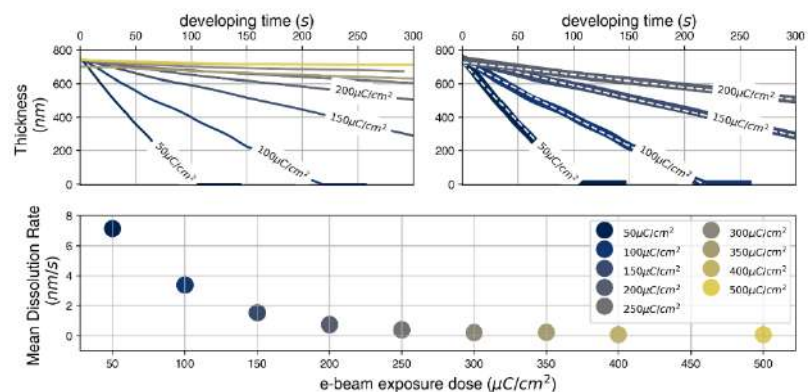
FEATURES

- Teflon cell: 110x35x130 mm
- Optical window: 18 mm (diameter)
- Liquid capacity: 30 - 40 ml
- Sample holder for samples of any shape in the 30x45 mm range.



FR-Liquid consists of a PTFE (Teflon) cell and a holder to accommodate the sample under test. PTFE, due to its properties (hydrophobic, chemical and thermal resistant) make suitable the use of FR-Liquid for a wide range of liquids. Optical measurements with the FR-Basic tool are possible due to the optical window design on the cell, which establishes the non-contact between the optical probe and the liquid.

FR-Liquid supports also the use of external micropumps, for the circulation of the liquids.



Thickness evolution during the development step corresponding to all selected exposure doses, and (top-right) only to high development rates. (bottom) The mean dissolution rates expressed as a function of e-beam exposure dose.

FR-IntSphere: Total & Diffuse Spectral Reflectance Measurements

FR-IntSphere kit is an accessory for FR-pRo and FR-ES tools for: Total, Diffuse, Specular Reflectance / Transmittance measurements. The kit consists of an integrating sphere of 50mm diameter, the appropriate optical fibers and holders. It is fully controlled through FR-Monitor software for the calculation and analysis of all parameters (reflectance, color, etc.).

APPLICATIONS

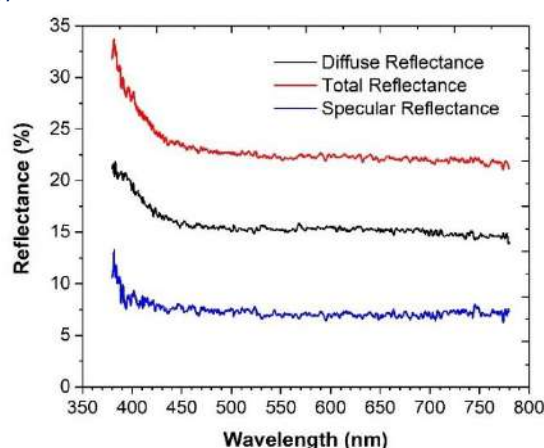
- Photovoltaics
- Diffuse materials
- Textiles
- Automotive paints
- Gemology
- General Lighting

FEATURES

- Total / Diffuse / Specular Reflectance/Transmittance
- Haze
- Irradiance
- Color properties ($L^*a^*b^*$)
- Wide spectral range
- Ideal for manufacturing
- Wide range of light sources, optical elements, & other configurations.



FR-IntSphere kit along with a FR-tool is a holistic solution for reflectance measurements, without any additional modules. The integrating sphere is made of a highly reflective, Lambertian surface (PTFE), with 10mm sample port diameter and easy to operate. The entrance and the exit ports are at **8 degrees** from normal incident to block the specular reflection of the sample by using a light trap and measure the **Diffused reflectance**. By replacing the light trap with a gloss trap (same material as the internal of the sphere), the **Total reflectance** is measured.



Total, Diffuse and Specular Reflectance measurements of a painted aluminum sample, as they were measured using an FR-pRo tool equipped with an integrating sphere.

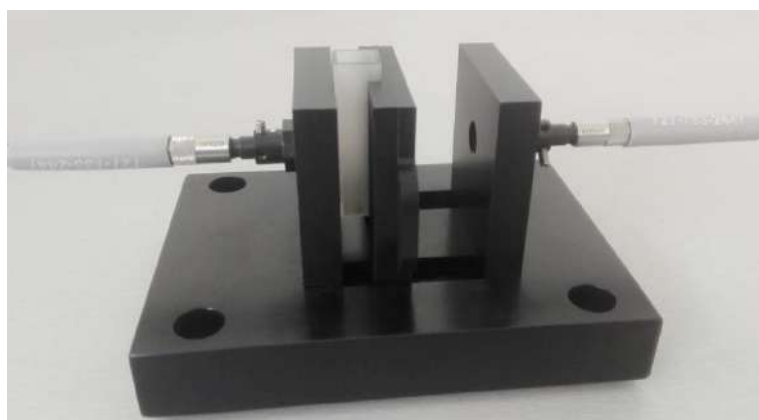
*Specifications are subject to change without any notice.

Film/Cuv Holder: Absorbance & Transmittance of liquids and films

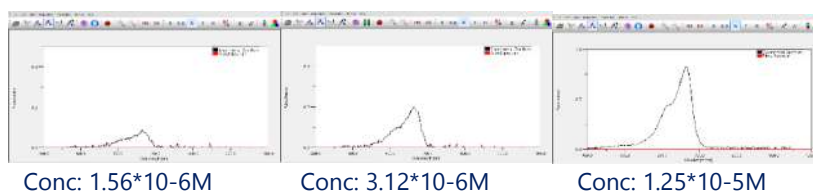
Transmittance measurements of liquids and coatings is a quite standard method for the characterization of the related materials.

Film/Cuv holder is designed to cover the needs for the characterization of both liquids and solid samples (semi-transparent and transparent samples of supported and un-supported (suspended) films).

It is offered in either 2W (two ports configuration) or in 4W (four ports configuration).



The **Film/Cuv Holder** is secured on FR-pRo tools and couples to the light source and spectrometer via standard SMA-905 optical fiber. Thanks to its unique design, it can be easily operated, it saves precious lab space and ensures absolute transmittance and absorbance measurements of high repeatability of either liquids or coatings. The holder can accommodate standard 1-cm cuvettes and solid samples with total thickness up to 10mm.

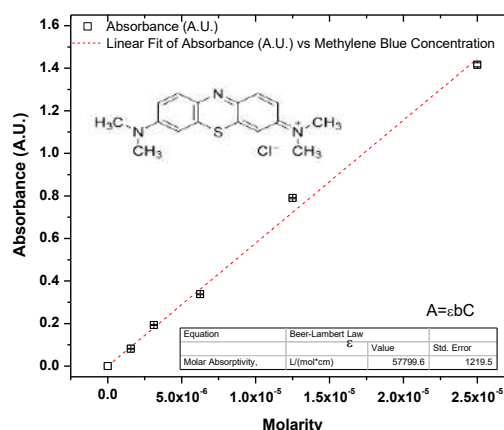


APPLICATIONS

- Transmittance
- Absorbance
- Film Thickness

FEATURES

- Footprint: 130x95x20 mm
- Film/Cuv Holder: 60x50x50mm
- SMA905 Fiber Connectors



Absorbance curve of Methylene Blue at 668nm at 25°C

FR-Mic-Adaptor: Optical microscope adaptor for spot size down to 5 μ m

FR-Mic-Adaptor is an FR-pRo / FR-ES accessory for use with trinocular microscopes with C-mount. It is the ideal accessory for applications that require spot size as small as very few microns. With FR-Mic-Adaptor, local film thickness, optical constants, reflectance, transmission, and absorbance measurements across the spectral range of FR-tool and microscope, is just a matter of a click.

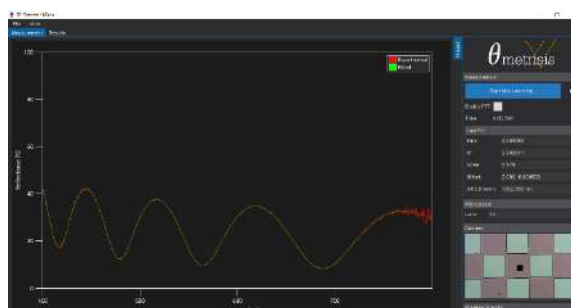
APPLICATIONS

- **Universities & Research labs**
 - **Semiconductors** (Oxides, Nitrides, Si, Resists, etc.)
 - **MEMS devices** (Si devices, Photoresists etc.)
 - **LED**
 - **Data Storage**
 - **Anodization**
 - **Hard/Soft coatings on curved substrates**
 - **Polymer coatings, adhesives, etc.**
 - **Biomedical** (parylene, balloon wall thickness, etc.)
- And many more...



With FR-Mic-Adaptor, **any trinocular optical microscope with C-mount is converted into a powerful coating characterization tool** capable to measure film thickness down to 20nm.

FR-Mic-Adaptor comes with a high-resolution USB camera for simultaneous visualization of the probed area and local characterization of coatings and a unit to record the dark spectrum (baseline). The installation of FR-Mic-Adaptor is straight forward and does not affect the specifications and operation of the microscope.



* The FR-pRo / FR-ES should support the spectral range of the microscope. Usually the min wavelength is 400nm, due to the objective lenses' characteristics.

FR-AutoFocus: Autofocus module for FR-Mic

FR-AutoFocus is an FR-Mic accessory for automatic focusing with any lens with magnification < 50X.

APPLICATIONS

- **Universities & Research labs**
 - **Semiconductors** (Oxides, Nitrides, Si, Resists, etc.)
 - **MEMS devices** (Photoresists, Si membranes, etc.)
 - **LED**
 - **Data Storage**
 - **Polymer coatings, adhesives, etc.**
 - **Biomedical** (polyethylene, balloon wall thickness, etc.)
- And many more...



FR-AutoFocus module is compatible with FR-Mic and allows for automatic focusing through the motorized and computer-controlled Z-axis. **FR-AutoFocus is fully controlled by the FR-Monitor v4.0** software and supports two modes: maximum intensity (of wide use in non-patterned areas) and image focus (mainly used in patterned areas).

FR-AutoFocus offers long scanning distance to cover any individual need and the user can set the scanning distance to optimize the focusing speed. In addition, FR-AutoFocus module operates in manual mode if needed. This module finds wide usage in automated FR-tools (e.g. FR-Scanner) where user wants to have the minimum intervention. FR-AutoFocus can be also coupled with FR-AutoTurret and FR-FilterWheel accessories and increase considerably the automation and productivity of the FR-tool.

Travel Distance:	55mm max
AutoFocus mode:	Image focus (contrast) / Reflectance intensity
Focus step	Lens magnification depended. Software adjustable (adaptive algorithm)

FR-FilterWheel: Computer-controlled selection of filter in FR-Mic

FR-FilterWheel is an accessory for FR-pRo, FR-Mic and FR-Scanner tools. It allows for computer-controlled selection of the filter to be placed in front of the light source and block the desired spectral regimes.

APPLICATIONS

- **Universities & Research labs**
- **Semiconductors** (Oxides, Nitrides, Si, Resists, etc.)
- **MEMS devices** (Photoresists, Si membranes, etc.)
- **Spectral filtering**



FR-FilterWheel module is used for the computer-controlled filtering of the light emitted from the light source embedded in FR-pRo and FR-Scanner tools. It is also compatible with FR-Mic and is equipped with a wheel that can accommodate up to 8 filters, with diameter of 1inch (clear aperture 23mm).

FR-FilterWheel is fully controlled through the FR-software and the user can easily define which filter slots are loaded with filters and the name of each filter and which slots are open and available for loading of extra filters. This module, finds wide usage in fully automated tools and supports the minimum intervention of the user (only load/unload of the wafer under characterization in the wafer chuck).

The module is provided without any filters. There is a long list of available filters that can be inserted in the wheel (e.g. longpass (L42, Y44, Y48, Y50, O56, O58, R60, R62, R64, R70, ...), neutral, shortpass, bandpass). The user can insert any filter with diameter of 1in and max thickness of 4mm.

FR-AutoTurret: Motorized turret for FR-Mic

FR-AutoTurret is an accessory for FR-Mic module. It allows for computer-controlled selection of the objective lens to be employed in imaging.

APPLICATIONS

- **Universities & Research labs**
- **Semiconductors** (Oxides, Nitrides, Si, Resists, etc.)
- **MEMS devices** (Photoresists, Si membranes, etc.)
- **Characterization of patterned wafers**



FR-AutoTurret module is used for the computer-controlled selection of the objective lens for the operation of FR-Mic module. The **module offers 4-positions** for mounting of up to four objective lenses. Thanks to its advanced mechanism and electrical motor, the position repeatability is better than 0.02deg and typical switching speed between lenses of 2.0-3.0sec.

FR-AutoTurret is fully controlled through the FR-software and the user can easily define which lenses slots are loaded with objective lenses and the specifications of each lens and which slots are available for loading of extra lenses. This module, finds wide usage in fully automated tools and supports the minimum intervention of the user (only load/unload of the wafer under characterization in the wafer chuck).

The module is provided without any lenses. There is a long list of available long working distance objective lenses that can be used with FR-AutoTurret (both in VIS/NIR (5X, 10X, 20X, 50X) and UV/NIR (10X, 15X, 20X, 25X, 40X)).

TMR-01 Module: Accurate reflectance measurements over the whole reflectance range

FR-Lens Module is an accessory for optical measurements on coatings where a small ($<150\mu\text{m}$) spot size is required. The particular module is fully compatible with all FR-pRo / FR-ES and FR-Scanner platforms operating in UV/VIS/NIR spectral range.

APPLICATIONS

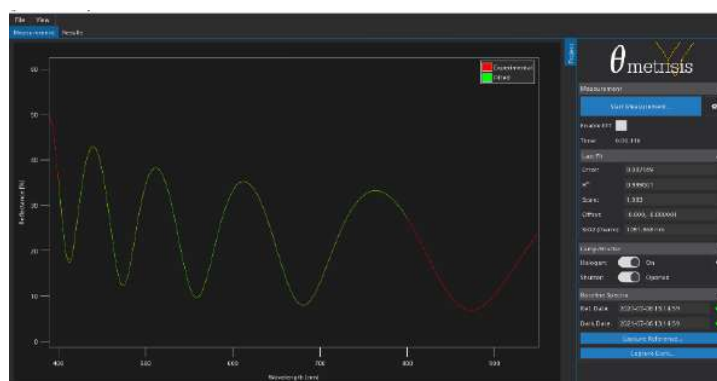
- Characterization of areas with small size or patterned areas
- Rough coatings
- Uneven samples
- Scattering samples

FEATURES

- Type: Triplet Achromatic Lens
- Wavelength range: 380-1000nm
- Diameter: 12mm
- Focal Length: 20mm
- Spot size: $< 150\mu\text{m}$
- Mounting: Secure and precise mounting on the reflection probe



The **FR-Lens Module** is easily attached on the reflection probe of any tool (FR-pOrtable excluded) and can cover the visible range (380-1000nm wavelength). In the standard configuration, the spot size becomes $<150\mu\text{m}$ in diameter and allows for the characterization of coatings with moderate roughness. Additional configurations can be provided upon request.



Thickness measurement of SiO_2 film on Silicon substrate.
Thickness: 1051.4nm.

FR-Emission: Plasma Emission monitoring

FR-Emission is a compact module for in-situ monitoring of plasma-based semiconductor thin-film process (e.g. etching and sputtering). FR-Emission module operates in the UV/VIS/NIR (200-1100nm) spectral range and cover a wide range of applications thanks to the wide collimating lens.

APPLICATIONS

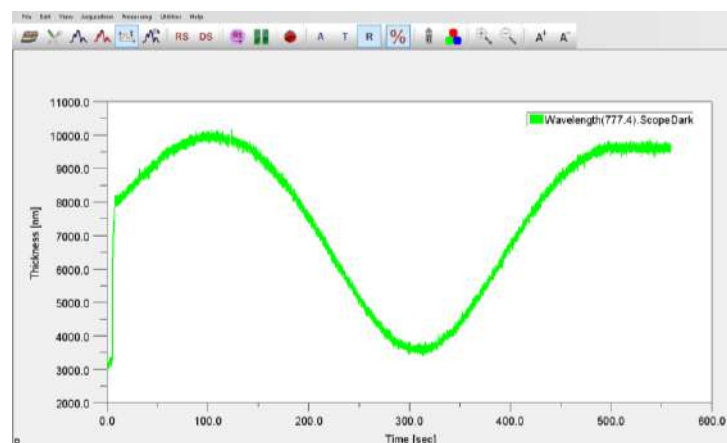
- Microelectronic processes
- Etching & sputtering
- End-point process detection

FEATURES

- 4096pixels detector, 300lines/mm grating
- 10 μ m slit
- 16 bit A/D
- Wide spectral range
- High optical resolution: 0.5nm
- Fast sampling time
- 400 μ m solarized fiber, 1m long
- UV/VIS/NIR collimating lens, 25mm diameter



The **FR-Emission Module** is easily attached to an optical port of the plasma processing chamber. It is equipped with a collimating lens (25mm diameter) to capture the emission light and with a high-resolution spectrometer that provide fast sampling time over a wide spectral range. FR-Emission comes along with FR-Monitor 4.0 (Win 10/11) software for the capturing and processing of the acquired spectra. Additional configurations can be provided upon request.



Real-time monitoring (a.u.) of the plasma emission during processing with O₂ (photoresist etching)

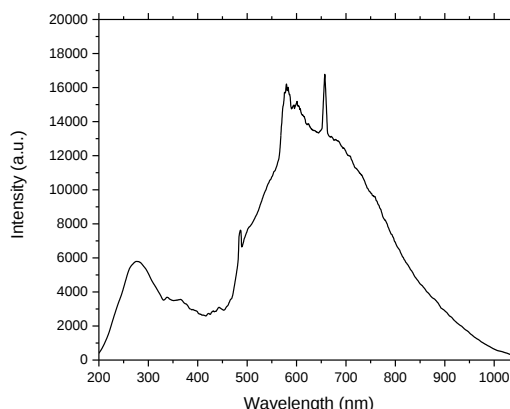
LS-2: External Deuterium-Tungsten Light Source

Enhance your optical experimentation with a cutting-edge light source with an integrated shutter and a filter holder. **LS-2** is a dedicated light source with emission in the **190-2500nm spectral range** using a combination of deuterium and halogen lamps and equipped with a mechanical shutter. The shutter is operated through a switch or TTL signal. The filter holder can accommodate filters up to 3mm thick and 25mm square in size, allowing for even more customization of the emitted spectrum. The light source is operated either manually or through ThetaMetrisis software and related FR-API giving complete control over the light source.



SPECIFICATIONS

Emission spectrum	190nm to 2500nm
Lamps	20W Deuterium Lamp 5W Tungsten Lamp
Warm-up Time *	20min @room temp, free airflow, no vibration
Lamp Life time	2000h Deuterium/ 4000h Halogen (MTBF)
S/W control	FR-Monitor 4.0 compatible
Filter holder	Included
Optical connector	SMA905
External control	TTL (D-sub 9-pin), USB (USB type A), switches
Cooling method	Forced air with fan
Operation Humidity	5-95% without condensation at 40 °C
Operation Temp	5-35 °C
Shutter Lifetime	1M cycles
Power	85-264VAC(RMS), 1.8A@115V, 1.05A@230V
Dimensions & Weight	200mm x 110mm x 272mm (WxHxL) / 3.2Kg



Emission spectrum as recorded from reflectance from plain Si wafer through spectrometer with Si CCD

XY-M75 / M100 / M200: Two-axes Linear Translation stage for FR-tools

XY-M linear stage is a dedicated accessory for any FR-pOrtable / FR-pRo / FR-ES tool. It allows the manual thickness & optical properties mapping of samples fast, easily and accurately.

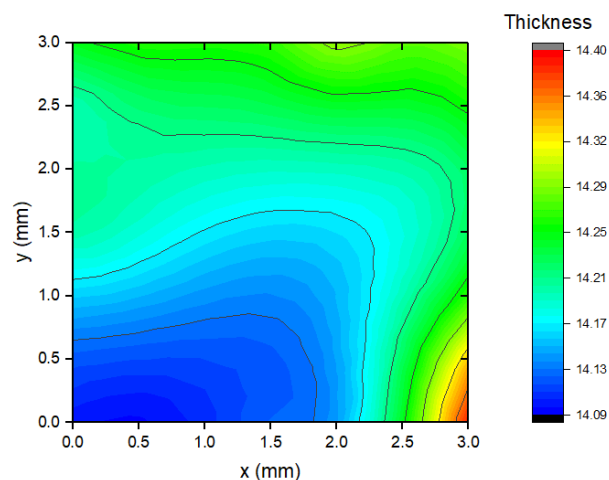
The linear stage is offered in three travel ranges (75X55mm, 100X100mm, 200X200mm) and is suitable for both Reflectance and, Transmittance measurements through the embedded optical window.

FEATURES

- Manually controlled (knob on the top)
- Travel range: 100X100mm
- Sample: Dia. 100mm (max)
- Spring Clips
- Reflectance & Transmittance
- Stage size: 285x205x330mm



All XY-M stages (75X55mm, 100X100mm and 200X200mm) are equipped with a knob and rulers to facilitate the movement at certain coordinates. The stage is mounted wither on the FR-tool or next to the tool (XM-M200) and secures the probe at the center of the stage.



Thickness mapping (30mmX30mm) of SU-8 film spin coated on Si wafer with measurement step of 5mm, is illustrated. The thickness (scale bar in μm) varies from 14.09 μm to 14.40 μm .

XY-LargePlatform: XY manual platform with 300x200mm traveling distance

XY-LargePlatform is an accessory for any FR-pOrtable / FR-pRo / FR-ES tool. It allows the manual thickness & optical properties mapping of large samples fast, easily and accurately.

The platform can be moved manually at any point within an area of 300X200mm and comes with engraved patterns of the standard wafers to facilitate fast characterization of coatings on any wafer or other substrate with dimension up to 300mm.

FEATURES

- Manually controlled
- Travel range: 300X200mm
- Sample: Dia. 300mm (max)
- Reflectance & Transmittance
- Stage size: 285x205x330mm

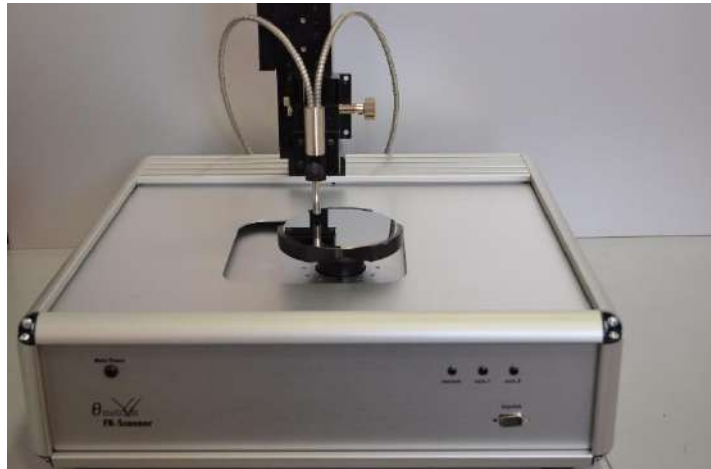


The **XY-LargePlatform** is a cost-effective solution for fast characterization of a small number of points of coatings of substrates with large footprint. The platform moves fast and manually and the user can bring under the probe any point of the substrate. It supports (upon request) reflectance and transmittance measurements.

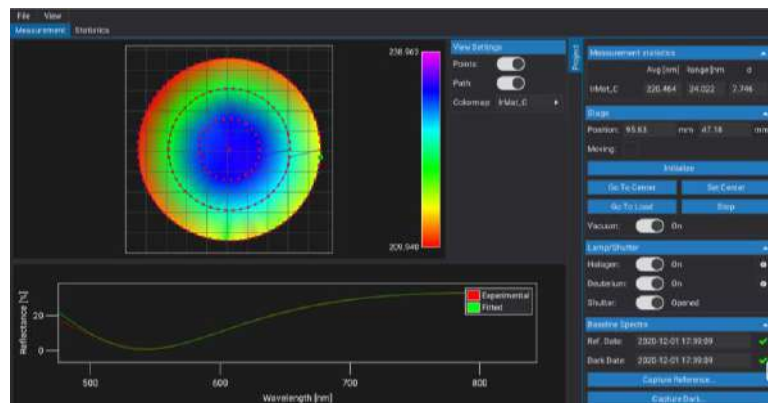
XY-A100: Motorized stage for fast mapping of coatings at Cartesian coordinates

XY-A100 linear stage is a dedicated accessory for FR-pRo tools. The linear stage which provides a 100mm of travel along X and Y is suitable for Reflectance measurements while the sample is secured through vacuum.

XY-A100 linear stage allows for the automatic, through FR-Monitor, thickness & optical properties mapping of samples fast, easily and accurately.



The **XY-A100 stage** is compatible with any FR-pRo tool and can be employed in the characterization of coatings on any substrate (wafer, square, arbitrary shape) up to 100X100mm in size. The sample is held down through vacuum provided by any standard pump, or vacuum line.



SPECIFICATIONS

- Travel range: 100X100mm
- Sample: Dia. 100mm (max)
- Accuracy: 2.5µm in each axis
- Reflectance measurements
- Stage size: 430x430x300mm

Thickness mapping of a 4inch Si wafer coated with a photoresist film. The statistical results (number of points, mean thickness, standard deviation etc.) are listed in the tab at the top right.

RΘ-A150: Motorized stage for fast mapping of coatings at Polar coordinates

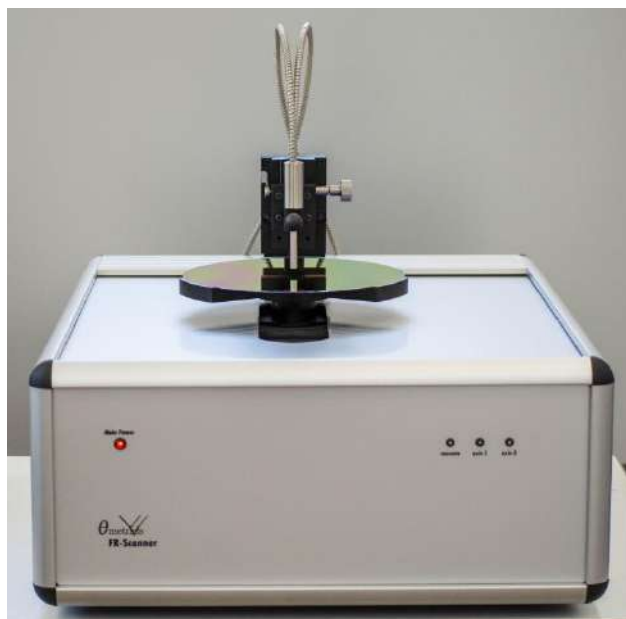
RΘ-A150 is a powerful motorized stage operating in Polar coordinates. It can accommodate any standard wafer up to 300mm in diameter. It is operated through any FR-pRo unit and it comes along with one vacuum chuck.

APPLICATIONS

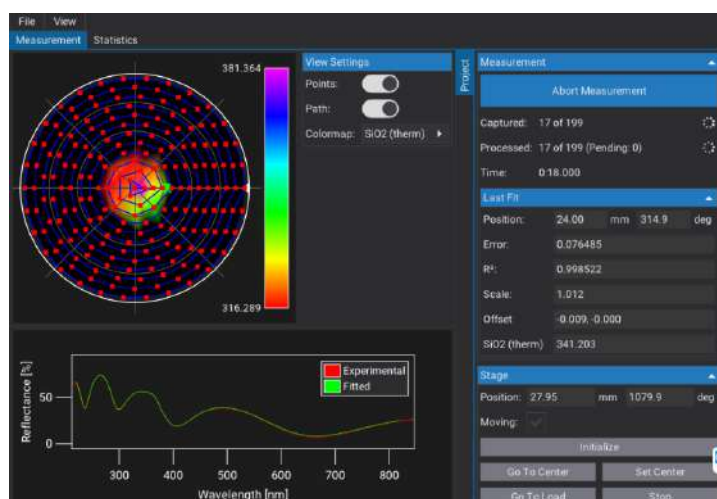
- Mapping of thickness, refractive index, colour etc of any standard wafer up to 300mm in diameter.
- Characterization of areas with small size or patterned areas
- Rough coatings
- Uneven samples
- Scattering samples

FEATURES

- 200measurements /min on 8inch wafer
- Accuracy: $2.5\mu\text{m}$ / 0.1°
- User Friendly software for fast routine operation.
- FR-Mic module can be further attached for small spot size



The **RΘ-A150 stage** is a stable-top unit for the automatic characterization of coatings on wafers. It is operated through any FR-pRo unit and operates either under FR-Monitor or via the independent software that has been especially developed for daily routine use. The maximum scanning speed on 8inch wafers is 200points/min.



*Available in RΘ-200 configuration as well

Rθ-A300-HW: Motorized stage for fast mapping of coatings on Heavy Substrates

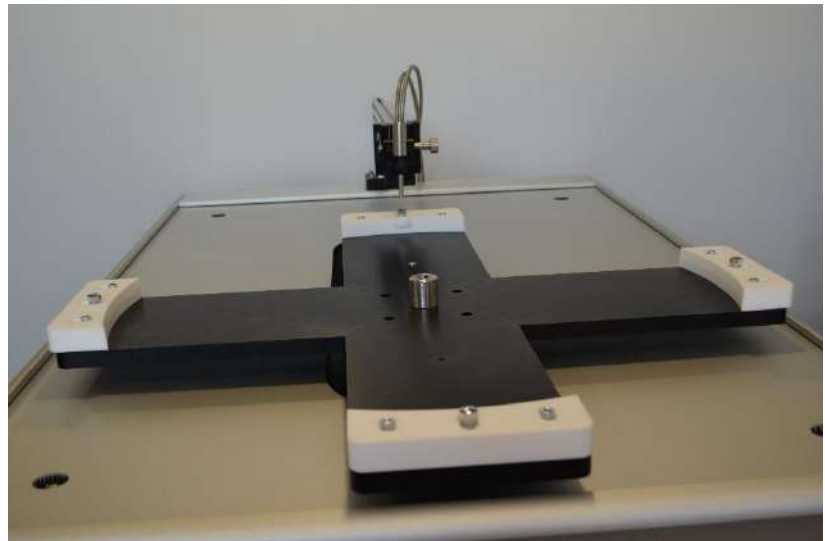
Rθ-A300 HW is a powerful motorized stage operating in Polar coordinates. It can accommodate any disc with diameter up to 600mm. It is operated through any FR-pRo unit and it comes a dedicated check equipped with reference standards.

APPLICATIONS

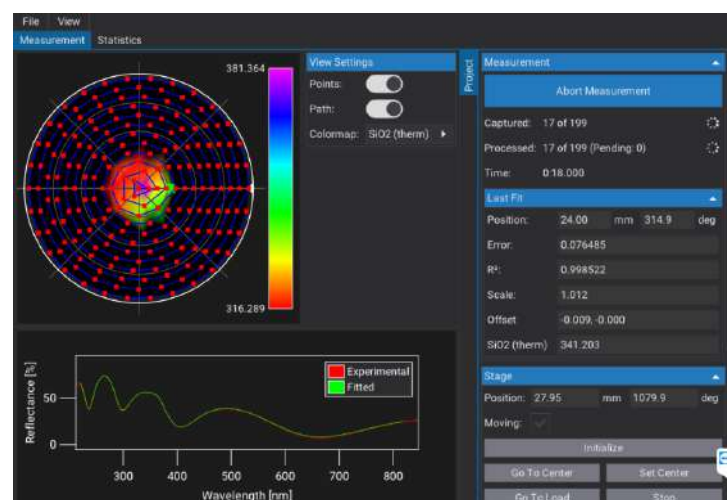
- Mapping of thickness, refractive index, colour etc on any disc with diameter up to 600mm.
- Characterization of areas with small size or patterned areas

FEATURES

- Accuracy: $5\mu\text{m} / 0.1^\circ$
- User Friendly software for fast routine operation.
- FR-Mic module can be further attached for ultra-small spot size



Rθ-A300 HW is a unique table-top stage for the automatic characterization of coatings on heavy weighted discs (e.g. ceramic disks for lapping) with any diameter $\leq 600\text{mm}$. It is operated through any FR-pRo unit and controlled by FR-Monitor v4.0 software. This heavy-duty stage has been designed for long maintenance free usage in relevant industrial environments.



FR-pRo R/T/C: Reflectance, Transmittance and Color characterization

Color science has significant importance in manufacturing industry and research.

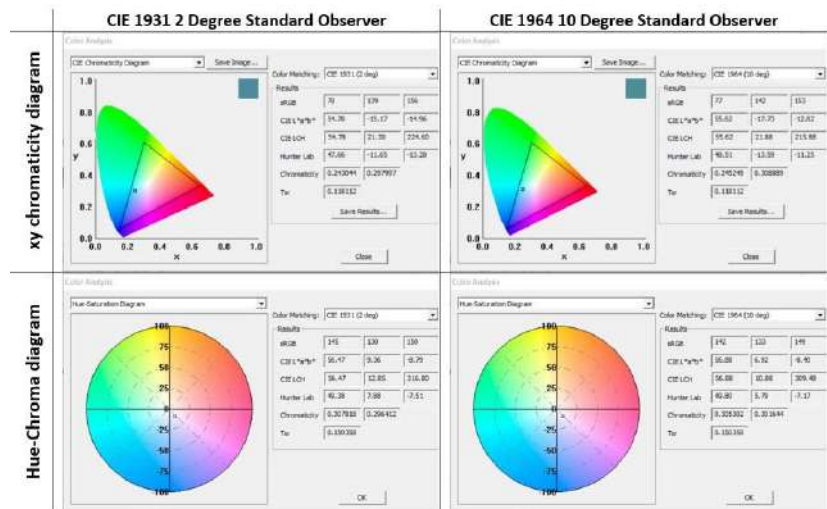
FR-pRo R/T/C is a tailored tool for the simultaneous characterization of Reflectance, Transmittance and Color measurements with one-click.

Color spaces available:

- CIE L*a*b*
- CIE LCh,
- Hunter Lab

APPLICATIONS

- **AR coatings on glass lenses**
- **MEMS devices** (Si membranes, etc.)
- **LED, OLED**
- **Hard/Soft coatings on curved substrates**
- **Polymer coatings**, adhesives, etc.
- **Biomedical** (parylene, balloon wall thickness, etc.)
- **And more...**
(contact us with your requirements)



FR-pRo R/T/C tool relates the reflectance spectra taken upon a sample to color tristimulus values: XYZ, using two established international conventions:

- 2° standard observer (CIE, 1931)
- 10° standard observer (CIE, 1964)

providing

- chromaticity diagrams, and
- the following list of parameters:

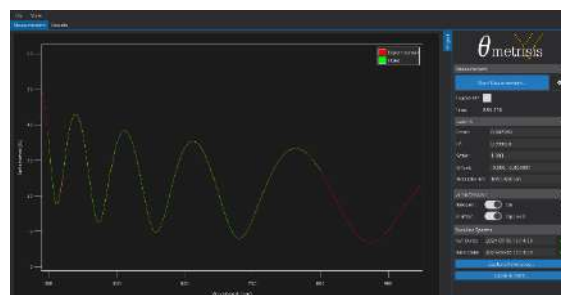
sRGB	R	G	B
CIE L*a*b*	L*	a*	b*
CIE LCh	L	C	H
Hunter	L	a	b
Chromaticity	x	y	

Depending on the application, different optical configurations can be implemented in the tool such as:

- **Contact probe** for curved surfaces such as glass lenses
- **Integration Spheres** for diffuse & total reflectance (di:8°, de:8° geometry)

FEATURES

- Single-click analysis (no need for initial guess)
- Dynamic measurements
- Optical parameters (n & k, color)
- Multiple installations for off-line analysis
- Free of-charge Software update



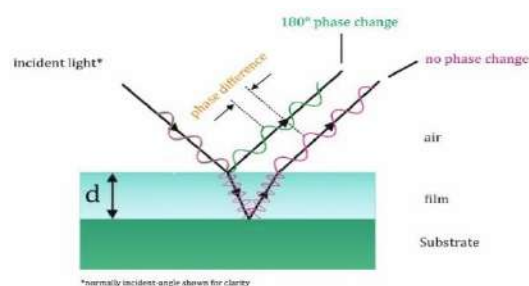
SPECIFICATIONS

Spectral Range (nm)	370 – 1020
Pixels	3648
Thickness range (SiO₂)	12nm – 100um
Min. Thick. for n&k	100nm
Thickness Accuracy *,**	1nm or 0.2%
Thickness Precision*,**	0.02nm
Thickness stability *,**	0.05nm
Spot size (diameter)	350um (smaller options upon request)
Material Database	> 800 different materials

	Optical probe (standard) / Contact probe	Integrating sphere (50mm diameter)
Illumination/viewing system	Specular reflectance (0°)	di:8°, de:8° (diffused illumination, 8°
Illumination area	0.3mm (standard)	10 mm (port size)
Observer		2° / 10°
Illuminant	D65 (standard – others available after request)	
Color matching		CIE 1931, CIE 1964
Colorimetric Data	L*a*b*, L*C*h*, Hunter Lab, sRGB, xy, Tsr (Total solar reflectance)	
Chromaticity Diagrams		CIE 1931, CIE 1964

PRINCIPLE OF OPERATION

White Light Reflectance Spectroscopy (WLRS) measures the amount of light reflected from a film or a multilayer stack over a range of wavelengths, with the incident light perpendicular to the sample. The measured reflectance spectrum, produced by interference from the interfaces is being used to determine the thickness, optical constants (n & k), etc. of free-standing and supported (on transparent or partially/fully reflective substrates) stack of films.

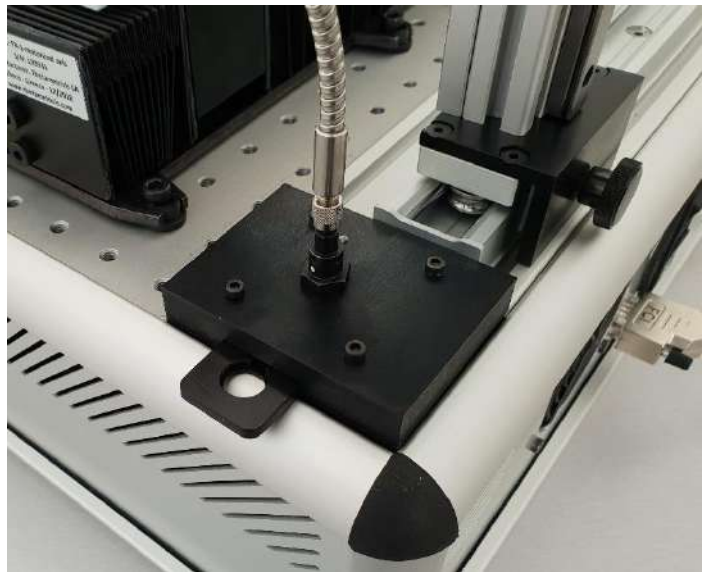


*Specifications are subject to change without any notice,

FR-pRo-FH: Filter holder for FR-pRo units

FR-pRo-FH is a filter holder that can be mounted on the light emission port of any FR-pRo unit.

It can accommodate any light filter (low-pass, high-pass, band-pass) and configure the emission spectrum accordingly.



FR-pRo-FH can accommodate any commercially available filter of either 1/2inch or 1inch diameter. The filter can be either low-pass, high-pass or band-pass.

FEATURES & APPS

- Optical and Thickness measurements at selected spectral regimes
- Easily mounting on any FR-pRo tool
- Ideal for the evaluation of photoresists films
- Fully configurable by the usage of any commercially available low-pass, band-pass and high-pass filter

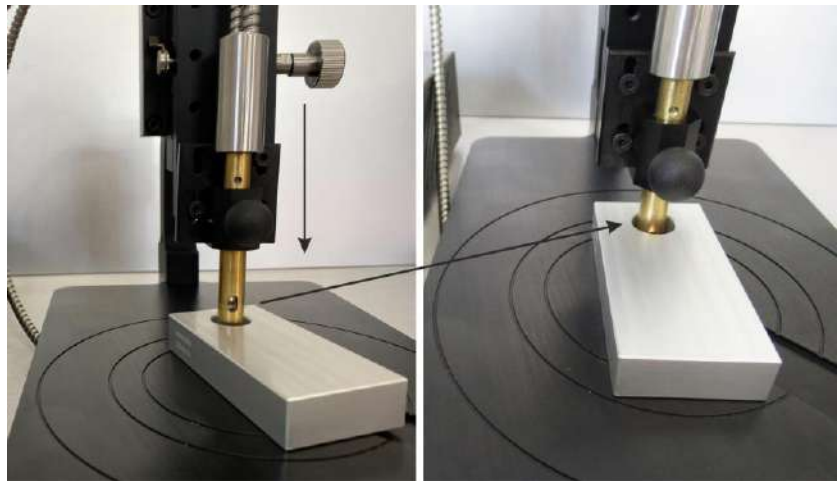
FR-90-H: Module for measurements at 90°

FR-90-H is a dedicated module for characterization of films (e.g. anodized aluminum) inside tubes and holes. The module is secured on the reflection probe and can be used with any FR-ES, FR-pRo and FR-pOrtable tool.

FR-90-H can be can accommodate any light filter (low-pass, high-pass, band-pass) and configure the emission spectrum accordingly.

FEATURES & APPS

- Optical and Thickness measurements at selected spectral regimes
- Easily mounting on any FR-ES or FR-pRo tool
- Ideal for the evaluation films inside holes (minimum hole diameter 10mm)
- Ideal for characterization of internal lacquers sprayed on beverage cans.



In certain applications films are deposited or created inside tubes (e.g. toothpastes), cans (e.g. aluminum cans for beverages) and holes (e.g. aluminum parts manufactured by CNC or lathe). **FR-90-H** is a dedicated module that can be secured on the reflection probe and facilitate reflectance and film thickness measurements inside curved samples with minimum diameter 10mm. By employing long reflection probes the characterization of inner surfaces of curved samples can be at any distance from the access (entrance) point.

FR-pOrtable-TR: Module for transmittance measurements

Transmittance measurements of coatings is a quite standard method for the characterization of the related materials. The **Transmittance kit** for FR-pOrtable is a module designed to cover the needs for the characterization of coatings (semi-transparent and transparent samples of supported and unsupported (suspended) films).

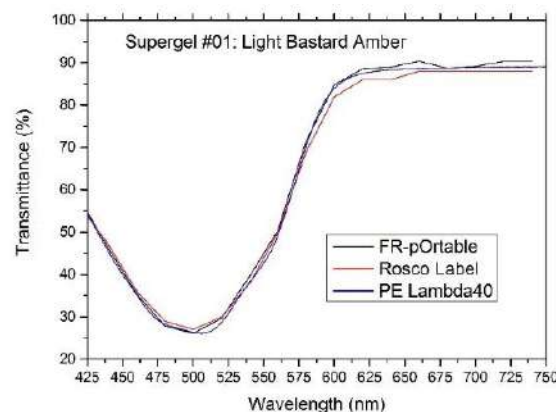


FEATURES

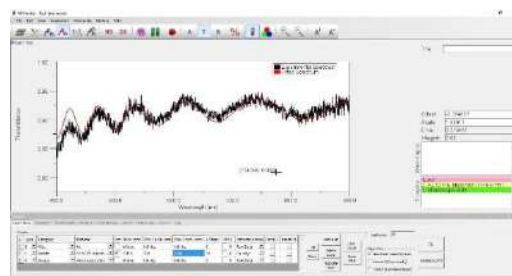
- It can be added anytime
- Software controlled
- Light source with extremely long life time (20000h)



The Transmittance module is secured below the base of FR-pOrtable and is equipped with a light source similar to the one used for the reflectance measurements. The light from the light source is aligned to the central fiber of the reflection probe. The light source is powered by the FR-pOrtable through the D-sub connector on the top and is controlled by the same FR-Monitor software.



Transmittance spectrum of a color filter compared with manufacturer's data and a high precision tabletop spectrometer



Thickness measurement of an AZ5214 resist film spin-coated on a microscope slide. Thickness: 1.1 μm

ContactProbe-ST: Thickness measurements of coatings at the field

ContactProbe-ST: the handheld accessory for thickness and optical measurements of coatings in the field.

Thanks to its design, the ContactProbe-ST can be easily attached on the reflection probe of any ThetaMetrisis' tool, allowing fast, easy and accurate measurements.

It is Ideal for curved samples and surfaces.

FEATURES & APPS

- Optical and Thickness measurements in the field
- Easy usage with any FR-pRo or FR-ES tool
- Soft spacer to protect the surface under test
- Blocks any ambient light
- Applicable at any flat and curved surfaces
- Ideal for Eye glass industry, Aerospace and Automotive industry



Contact probe-ST is a unique accessory for reflectance measurements of curved samples, e.g. lenses. It is equipped with a soft rubber ring (40mm diameter) to secure the correct distance between the probe and the point under characterization that does not harm the sample. The ContactProbe-ST can be mount on any FR-pRo or FR-ES tool and is operated by the standard FR-Monitor software.

Accuracy*: 0.5nm

Precision*: 0.5nm

Stability*: 0.5nm



Characterization of a multi-layer stack on a lens for automotive lamp.

* in terms of spectrum and depends on material

ContactProbe-20: Thickness measurements of coatings on surfaces with high curvature

ContactProbe-20: the handheld accessory for thickness and optical measurements of coatings on curved substrates. Thanks to its design, the ContactProbe-20 can be easily attached on the reflection probe, allowing fast, easy and accurate measurements.

It is Ideal for curved samples and surfaces.

FEATURES & APPS

- Optical and Thickness measurements at the field
- Easy usage with any FR-pRo and FR-ES tool
- Soft spacer to protect the surface under test
- Blocks any ambient light
- Applicable at any flat and curved surfaces
- Ideal for Eye glass industry, Aerospace and Automotive industry,



Contact probe-20 is a unique accessory for characterization of curved samples with high curvature. It is equipped with a soft rubber ring (20mm diameter) to secure the correct distance between the probe and the point under characterization that does not harm the sample. The ContactProbe-20 can be mounted on the reflection probe and used with any FR-pRo or FR-ES tool and is operated by the standard FR-Monitor software.

Accuracy*: 0.5nm

Precision*: 0.5nm

Stability*: 0.5nm



Characterization of a multi-layer stack on a lens for automotive lamp.

* in terms of spectrum and depends on material

Biosensing kit: Real-time & label-free monitoring of biomolecular interactions

The Biosensing kit is fully compatible with FR-pRo and FR-pOrtable tools and is used for real-time and label-free monitoring of immunoreactions.

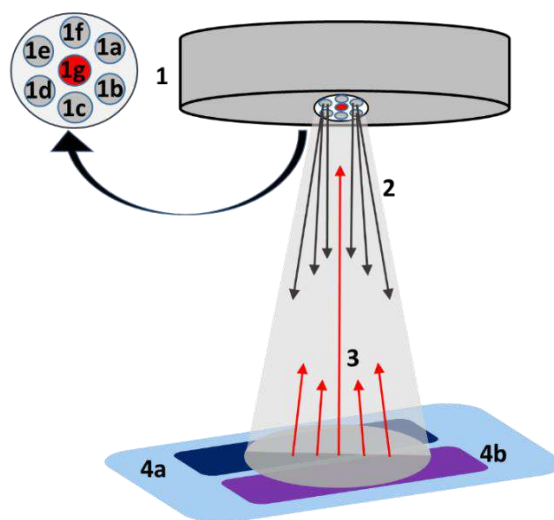
The miniaturized (5X15mm footprint) biochips, after appropriate bio-functionalization meets the needs for measurement of critical for human health biomarkers, as well as for harmful substances in food.

APPLICATIONS

- Label-free Biosensors
- Monitoring of kinetics of bioreactions
- Point-of-Need determinations

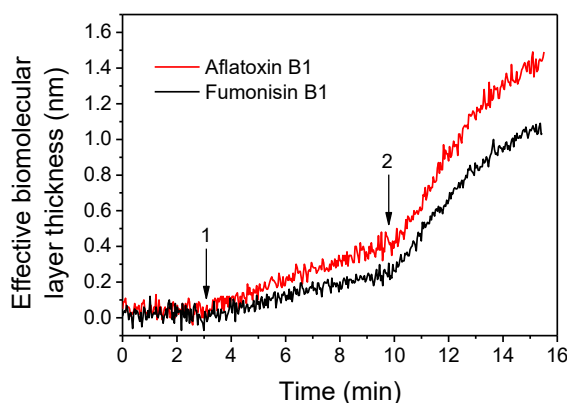
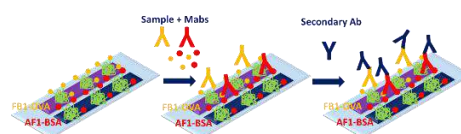
FEATURES

- Ultra-miniaturized footprint
- Single analyte determinations
- Multi-analyte determinations
- Fully compatible for operation with micropumps



The biosensing kit consists of a docking station especially designed to accommodate the biosensing chips and a number of appropriately fabricated Si chips and the related fluidic cells.

The biosensing kit was been extensively employed in the fast, accurate any with high dynamic range of a) a large variety of critical for human health biomarkers (T-PSA, f-PSA, CRP, d-Dimer, PCT, IL-6 etc.) and b) a large number of harmful substances in food; pesticides, mycotoxins and allergens.



OptMic-ES: Standard Optical microscope for R&D needs

OptiMic-ES is a standard trinocular microscope operating in reflectance mode. It is used for standard inspection of samples and can be coupled with FR-uProbe for reflectance and thickness measurements with a very small spot-size.

APPLICATIONS

- Standard inspection of samples
- Measurement of thickness at a very small area

FEATURES

- Spectral range: 400-1700nm
- Magnification 50X-400X
- 12V50W halogen lamp with brightness control
- Transmittance mode (optional)
- Integrated field diaphragm, aperture diaphragm and puller type polarizer.
- Stage travel range: 63mmX50mm



OptiMic-ES is a standard trinocular microscope that can operate both in reflectance and transmittance modes and serves the characterization of coatings on both reflective and transparent substrates. It is ready for mounting of FR-uProbe or FR-MicAdapter modules for the local characterization of coatings in terms of film thickness, reflectance, transmittance, refractive index.

OptiMic-ES is equipped with all standard features of optical microscopes such as:

- Trinocular inclined 30°
- Integrated field diaphragm, aperture diaphragm and puller type polarizer.
- Achromatic lenses: 5X/NA0.12/WD/26.1mm, 10X/NA0.25/WD20.2mm, 40X/NA0.60/WD3.98mm
- Ground-glass and yellow, green and blue filters

OptMic-200: Optical microscope for the inspection of large samples

OptiMic-200 is a trinocular microscope operating in reflectance mode. It is equipped with manual stage with travel range long enough to support the inspection of any wafer size up to 8inch diameter.



APPLICATIONS

- Standard inspection of samples
- Measurement of thickness at a very small area

FEATURES

- Spectral range: 400-1100nm
- Magnification 50X-200X
- 12V50W halogen lamp with brightness control
- Integrated field diaphragm, aperture diaphragm and puller type polarizer.
- Stage travel range: 204X204mm

OptiMic-200 is a trinocular microscope that operate in reflectance mode and serves the characterization of coatings on wafers with diameter up to 8inch. It is ready for mounting of the FR-uProbe or FR-MicAdapter modules for the local characterization of coatings in terms of film thickness, reflectance, refractive index, etc. OptiMic-200 is equipped with:

- Coaxial coarse/fine focus system, with tensional adjustable and up stop, minimum division of fine focusing: 1.0μm
- Trinocular inclined 30°
- Integrated field diaphragm, aperture diaphragm and (Y,B,G, ground glass) switching device.
- Push-pull type analyzer and polarizer.
- Achromatic lenses: 5X/NA0.12/WD26.1mm, 10X/NA0.25/WD20.2mm, 20X/N0.40A/WD8.8mm

Options: 50X/NA0.7/WD1.7mm, 80X/NA0.8/WD1.2mm

OptiMic-200-HS: Optical microscope for the inspection of large samples

OptiMic-200-HS is a top-class trinocular microscope operating in reflectance mode. It is equipped with large manual stage with large travel range to support the professional inspection of any wafer size up to 8inch diameter.

APPLICATIONS

- Standard inspection of samples
- Measurement of thickness at a very small area

FEATURES

- Spectral range: 400-1700nm
- Magnification 50X-200X
- Field of view: 25mm (max)
- 12V100W halogen lamp with brightness control
- Integrated field diaphragm, aperture diaphragm and puller type polarizer.
- Travel range: 210X210mm



OptiMic-200-HS is a top-class trinocular microscope that operate in reflectance mode and serves the characterization of coatings on wafers with diameter up to 8inch. It is ready for mounting of the FR-uProbe or FR-MicAdapter modules for the local characterization of coatings in terms of film thickness, reflectance, transmittance, refractive index.

OptiMic-200 is equipped with:

- BD reflected illuminator, with electronic variable aperture and field diaphragm, center adjustable; with switch for changing bright and dark field; with slots for filters and polarizing kit
- Coaxial coarse/fine focus system: coarse range: 35mm, fine precision: 0.8μm. With upper limit and tension adjustment.
- 0-35 degree tilting viewing head for adjusting the height of eye point, provides the best viewing angle to different users
- BD semi-APO DIC objectives 5X/NA0.15/WD13.5mm, 10X/NA0.30/WD9.0mm, 20X/NA0.50/WD2.5mm
- Stage travel range: 210x210mm with clutch handle for quick movement

OptMic-300-HS: Optical microscope for the inspection of patterned 300mm wafers

OptiMic-300-HS is a professional trinocular microscope operating in reflectance mode. It is equipped with manual stage with long travel range to support the inspection of any wafer size up to 12inch diameter.

APPLICATIONS

- Standard inspection of samples
- Measurement of thickness at a very small area

FEATURES

- Spectral range: 400-1700nm
- Magnification 50X-200X
- 12V100W halogen lamp with brightness control
- Integrated field diaphragm, aperture diaphragm and puller type polarizer.
- Stage travel range: 306X306mm



OptiMic-300-HS is a top-class trinocular microscope that operate in reflectance mode and serves the characterization of coatings on wafers with diameter up to 12inch. It is ready for mounting of the FR-uProbe or FR-MicAdapter modules for the local characterization of coatings in terms of film thickness, reflectance, transmittance, refractive index.

OptiMic-200 is equipped with:

- Tilting trinocular head, 0-35 degree adjustable, splitting ratio: 100:0 or 0:100
- Coaxial coarse/fine focus system: coarse range: 35mm, fine precision: 0.8μm. With upper limit and tension adjustment.
- BD semi-APO DIC objectives 5X/NA0.15/WD13.5mm, 10X/NA0.30/WD9.0mm, 20X/NA0.50/WD2.5mm
- Stage travel range: 306x306mm with clutch handle for quick movement

Reference substrates: Substrates for referencing needs

A wide list of **substrates for reference** are available. These reference substrates are employed for accurate specular reflectance measurements in the 190-1700nm spectral range.

FEATURES & APPS

- Reflectance standard: Si
- Reflectance standard: Al
- Reflectance standard: BK7

The list with standard reference substrates includes the following:

Si for medium reflectance levels:

- Si die 500μm thick, 20x20mm (it is shipped with all FR-tools), 10x10mm
- Si wafer Single Side Polished (4in, 6in, 8in)
- Si wafer Double Side Polished (12in)

BK7 for low-reflectance levels:

- BK7 glass (3mm thick, 40mm diameter) with absorbing backside coating for reduction of backside reflectance

Al for high reflectance levels (>95% in the 200-2500nm spectral range):

- Al (38mm diameter), it is shipped in a metal housing. Specular reflectance Al standard (fused silica with protective coating).

Si with patterned SiO₂ areas:

- Si die with areas for reflectance reference, SiO₂ calibration thickness and patterned SiO₂ areas for spot-size demonstration and calibration of micro-spot tools

All those standard reference substrates are always on stock

In addition to the standard substrates, custom reference substrates are also available, such as:

- Si dies, of any square/rectangular shape from 3in, 4in or 6in Single Side Polished wafers
- Fused Silica dies of any square/rectangular shape from 3in, 4in or 6in Single or Double side Polished wafers

Thickness standards: For performance evaluation & calibration needs

A wide list of **thickness standards for reference** are available. These reference substrates are employed for accurate specular reflectance measurements in the 190-1700nm spectral range.

APPLICATIONS

- Standard inspection of samples
- Measurement of thickness at a very small area

FEATURES

- Thickness standard: SiO₂ on Si 10nm-5μm
- Thickness standard: HC on acrylic: 8μm
- Thickness standard (Bilayer); Si₃N₄/SiO₂/Si

The list with thickness standards includes the following items which are always on stock:

- 1000nm SiO₂/Si (500μm thick, 20x20mm size) with a circular area of SiO₂. This thickness standard is shipped with every FR-tool and comes with calibration certificate
- 3000nm SiO₂/Si (500μm thick, 20x20mm size) with a circular area of SiO₂
- 100nmSi₃N₄/1000nmSiO₂/Si (500μm thick, 20x20mm size)
- HardCoat on Plexiglass: 8μm HC (nominal thickness)
- Parylene/Si (500μm thick, 20x20mm size)

In addition, custom thickness standards are also available upon request, such as:

- SiO₂/Si at any thickness (10nm-1000nm) on 4in Si wafer
- D263 glass (cover slips with nominal thickness 30-1000μm)

Wafer Chucks: Dedicated wafer and mask-blank chucks for FR-Scanner tools

A wide list of **wafer chucks** is available to facilitate the characterization of both standard wafers and samples of irregular shape. All wafer chucks are manufactured by high quality anodized aluminum and are fully compatible for usage in clean rooms.

Custom wafer chucks are also available for transparent substrates (e.g. masks, SiC wafers, fused silica wafers, etc.)

APPLICATIONS

- Characterization of wafers of standard sizes (up to 300mm in diameter)
- Characterization of samples of irregular shape
- For usage with FR-Scanners

FEATURES

- Single size wafer chucks
- Multi size wafer chucks



The list with standard chucks includes the following items which are always on stock:

Single-size Wafer Chucks:

- 3-in round chuck: accommodate standard 3in wafers
- 4-in round chuck: accommodate standard 4in wafers
- 6-in round chuck: accommodate standard 6in wafers
- 8-in round chuck: accommodate standard 8in wafers
- 12-in round chuck: accommodate standard 12in wafers

Photomasks chucks:

- 5009 mask blank chuck
- 6025 mask blank chuck

Multi-size Wafer Chucks:

- 200mm multiwafer chuck
- 300mm multiwafer chuck
- 100mm rectangular chuck (for tools with A100 stage only)
- 200mm multiwafer chuck with reference, dark and thickness standard modules (for tools with A200 stage only)

Special chucks

- 340mm round chuck: accommodate glass substrates with 340mm diameter

Non-Contact Micro-Dispensing tools

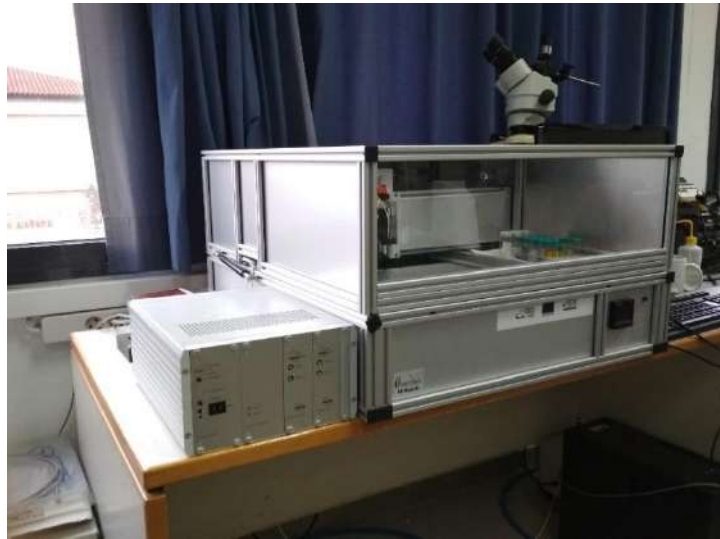
FR-Deposit: Controlled deposition of minute droplets of inks over large surfaces

FR-Deposit is a unique tool for the selective deposition of films following the layout drawn in an appropriate format. The tool is based on FR-Scanner platform on which a module with one or multiple inkjet heads is integrated. The system is accompanied with FR-Thermal kit for computer controlled thermal treatment of the substrate (up to 80 °C).

The system can be further expanded through a wide range of accessories.

Applications

- **Univ. & Research labs**
- **Polymeric patterns**
- **Printed electronics**
- **Biological spotting** (DNA and proteins patterns in microscale spots)
- **MEMS devices**
- And many more...
(contact us with your requirements)



FR-Deposit is shipped ready for deposition of polymeric layers along with the software drivers that allows for controlled deposition of polymeric drawings *

The system consists of the following modules:

- A module with piezo computer-controlled inkjet heads mounted on a Z-translational stage with fine resolution in steps. The inkjet heads are based on piezo-driven inkjet printing technology and are refilled by the user. Numerous inkjet heads are available. Standard inkjet head provides: Contactless dispensing, Single droplet volumes down to 30 pl, ultra-low variation of dispensed volume ~ 1%
- A motorized and computer-controlled axis on which the inkjet module is mounted.
- A vacuum stage for the accommodation of the substrate on which the polymeric drawing will be transferred. The stage is also equipped with a heating unit to keep the substrate at constant elevated temperatures. The stage is mounted on a computer-controlled axis which along with the axis of inkjet module allows for transfer of any drawing.
- Drop Observation Unit with strobe light for MD-K piezoelectric dispenser heads.
- Alignment unit for the manual alignment of the position of the droplet against the substrate

*Drawing supported: BMP files

SPECIFICATIONS

MECHANICAL SYSTEM

Stage	210X300mm, (motorized and computer controlled via USB)
Chuck type	Vacuum chuck
Hot plate temperature	Max temp: 80°C, Temp accuracy $\pm 2^{\circ}\text{C}$, Manual set temperature
Substrate thickness	0.3mm (min thickness) / 15mm (max thickness)
Z-axis range	100mm (manual through precision translational stage)
Printing area	210X300mm (A4 page)
Bi-directional Repeatability	Better than $10\mu\text{m}$
Position Accuracy	$5\mu\text{m}$
Movement Resolution	$1\mu\text{m}$

DROP OBSERVATION UNIT

MD-P-758	high-resolution USB-b/w camera with automatic dimmer, objective 10x, c-mount and strobe light for tuning of droplet size and frequency. The images of the droplets can be saved in the
MD-O-540	USB-b/w-camera, automatic dimmer, objective 10x, tube, C-mount

ALIGNMENT UNIT

Camera for Alignment	5MPixel USB colour camera for manual droplet alignment over printed patterns. Mag 10X. Alignment accuracy 0.1mm. Software alignment
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DISPENSING HEADS

MD-K-130-020	micro dispenser head without heater for liquids with a viscosity $<15\text{mPas}$; inner nozzle diameter $30\mu\text{m}$. Compatible with the dispensing of a wide range of materials based on water, solvents, Piezoelectric micro dispenser head with nozzle heater for liquids with a viscosity $>20\text{mPas}$; inner nozzle diameter $50\mu\text{m}$. Compatible with the dispensing of a wide range of materials based on adaptation of the design e.g. for higher viscous liquids, liquids with particles etc.
MD-K-140-020	
MD-G-080	
MD-E-3020-131	Control unit with Color Touch Screen and pressure control for 2x dispenser heads
MD-E-3021-131	Control unit for 2x dispenser heads with Color Touch Screen, pulse modulation, pressure control

SOFTWARE

Inkjet head driver	Windows (Win10, 64bit) driver for the control of the inkjet head (droplet configuration, deposition rate & characteristics) is Included
X & Y axes driver	Windows (Win10, 64bit) drivers for the control of X and Y axes through computer is included
Drop observation unit driver	Windows (Win10, 64bit) driver for the control of the camera is included
Alignment camera driver	Windows (Win10, 64bit) driver for the control of the camera is included
LabView application for the control of the system	Optional

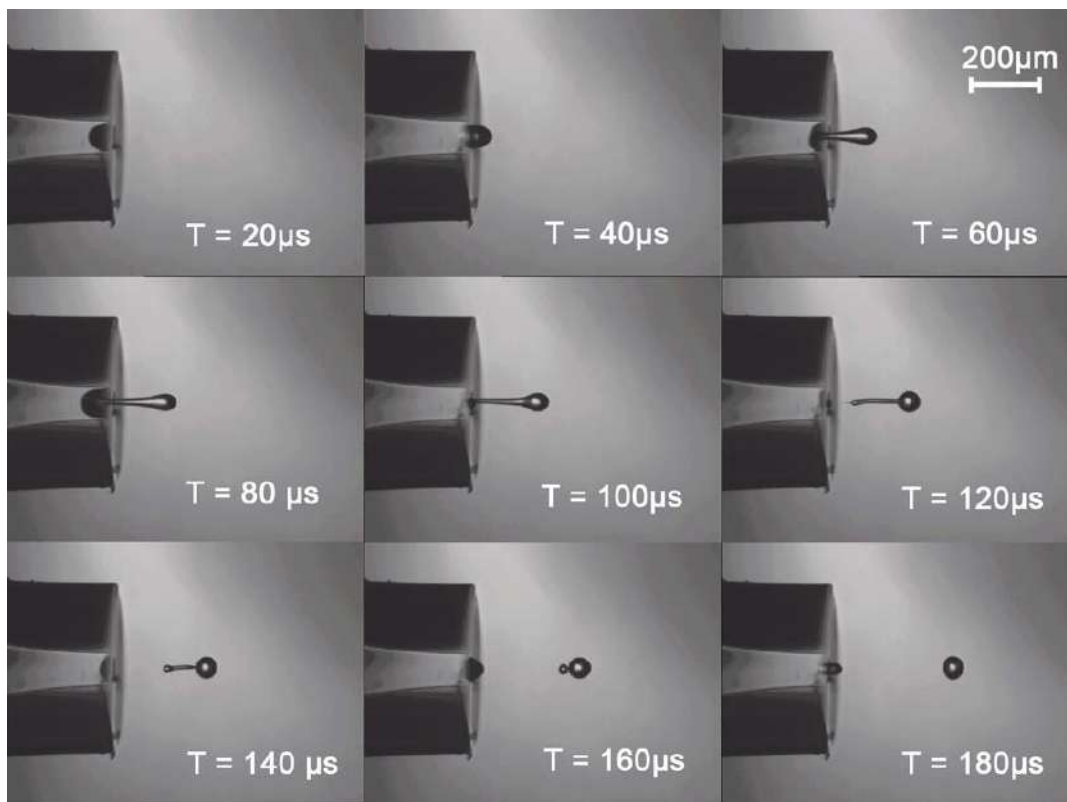
WEIGHT & DIMENSIONS

Housing	High quality Anodized aluminum
Cover	Included for stabilized temperature and appropriate printing environment
Size & Weight	800x1200x450mm (LxWxH), 67Kg

SOFTWARE SCREENSHOT

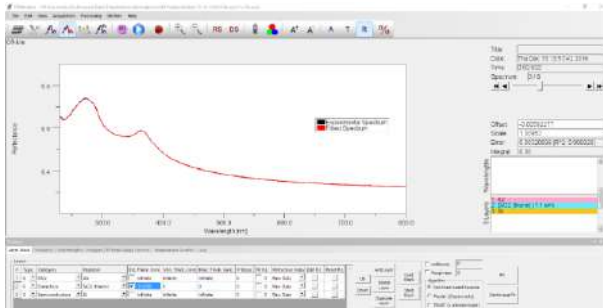


PICTURES FROM DROP INJECTION

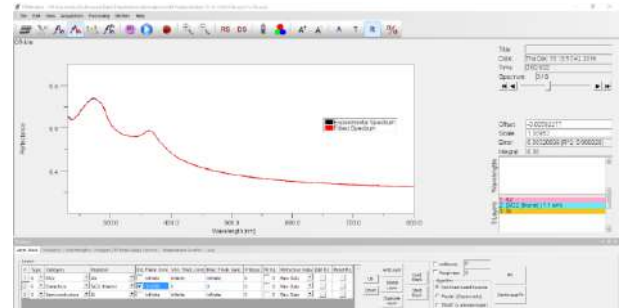
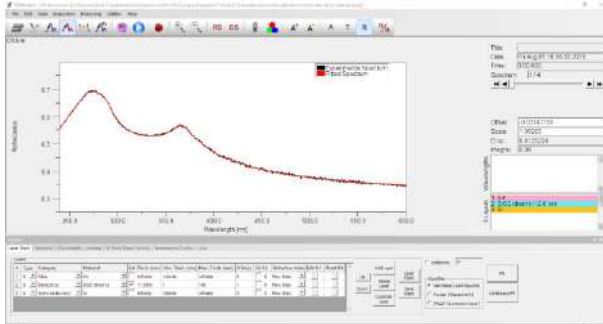


Appendices

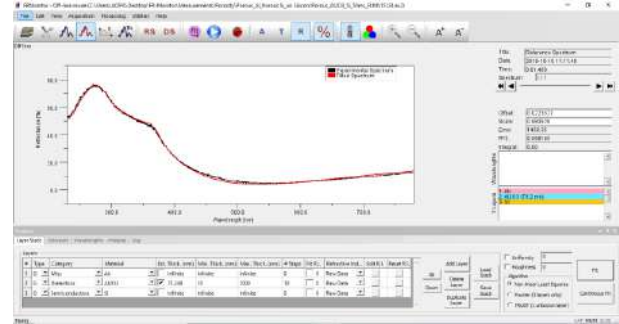
Typical Measurements



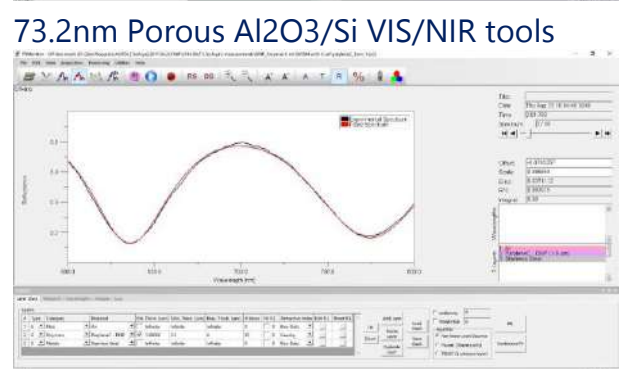
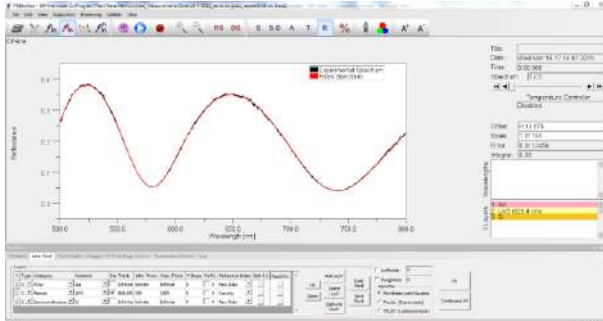
1.1nm SiO₂/Si UV/VIS tools



6.5nm Si₃N₄/Si VIS/NIR tools

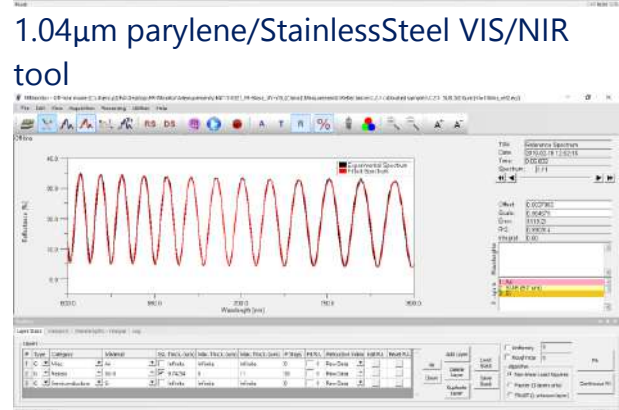
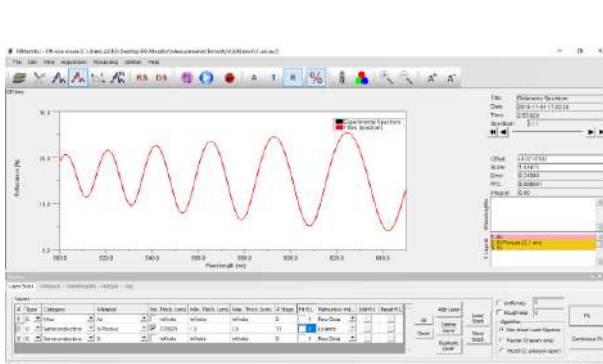


12nm SiO₂/Si UV/VIS tools, VIS/NIR tools



73.2nm Porous Al₂O₃/Si VIS/NIR tools

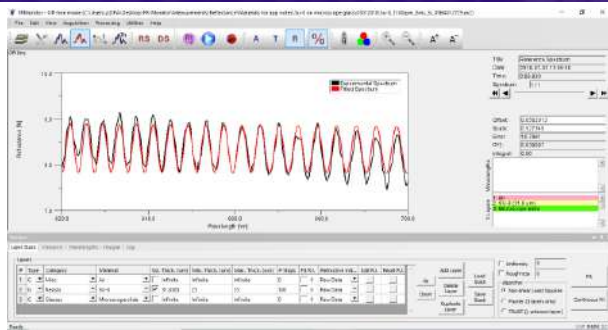
826.4nm UV5resist/Si VIS/NIR tools



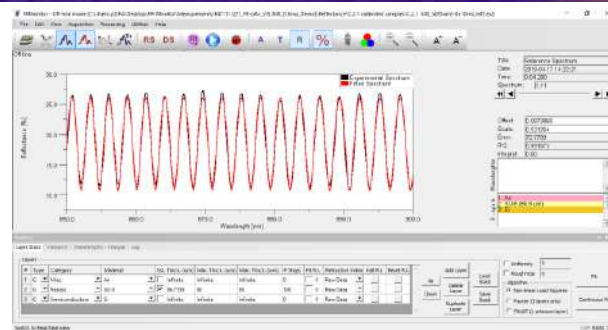
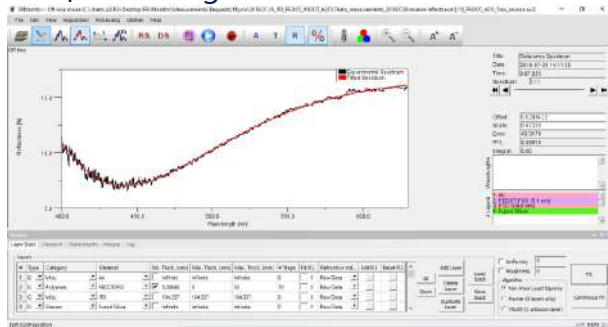
1.04µm parylene/StainlessSteel VIS/NIR tool

2.05µm porous-Si/Si, VIS/NIR tools

9.7µm SU-8/Si VIS/NIR tools

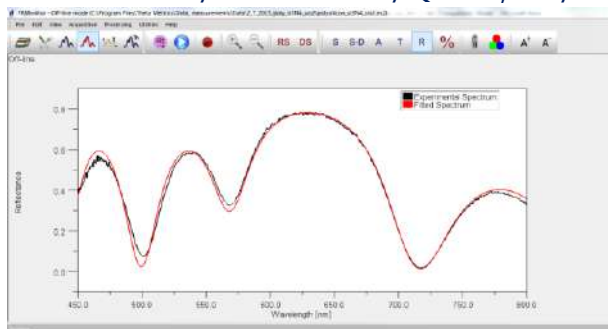


31.8µm SU-8/glass, VIS/NIR tools

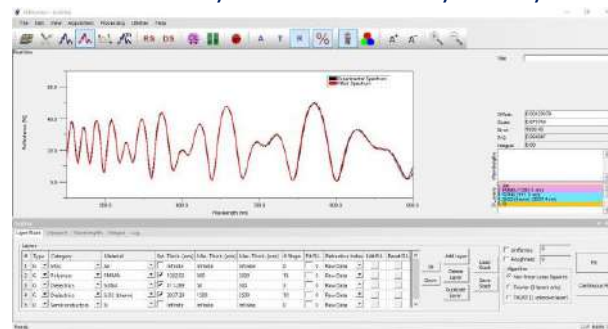


86.7µm SU-8/Si VIS/NIR tools

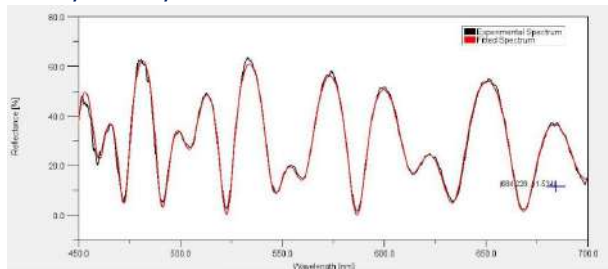
5.1nm PEDOT/104.6nm ITO/Quartz, VIS/NIR



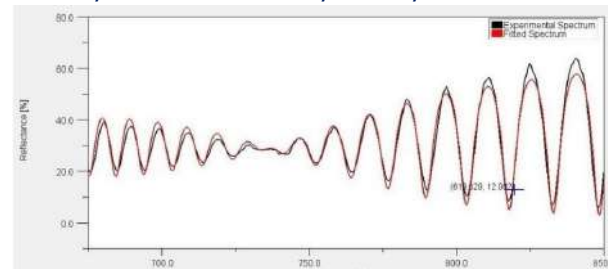
99.9 nm Si₃N₄/1086.7nm SiO₂/Si VIS/NIR



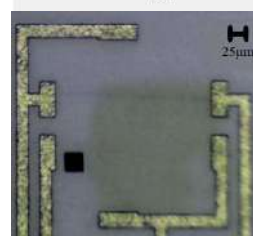
115.1nm poly-Si/148.2nm Si₃N₄/569.4nm SiO₂/Si VIS/NIR tools



1292 nm PMMA/111.3nm Si₃N₄/3037.4nm SiO₂/Si VIS/NIR tools



1520.6nm UV5 resist/202.2nm Si₃N₄/3090.7nm SiO₂/Si, VIS/NIR tools



5320.1nmSi/759.2nm SiO₂/Si (SOI wafer), VIS/NIR tools

Materials Database (>800 materials)

Dielectrics

a-La₂O₃
 Al₂O₃
 Al₂TiO₅
 AlN
 AlON (Aluminum OxyNitride)
 Anthracene
 BaB₂O₄ (BBO)
 BaF₂
 BaTiO₃
 BeAl₂O₄
 BeAl₆O₁₀
 BN (Boron nitride)
 BNO-20
 BNO-30
 BNO-50
 BNO-70-TT
 BO
 CaCO₃
 CaF₂
 CaGdAlO₄
 CaYAlO₄
 CeF₃
 CeO₂
 Cr₂O₃
 CrN
 CrSiO₂
 CsBr
 Cu₂O
 CuO
 Fe₂O₃
 Fe₃O₄
 GeO₂
 GeOx
 HfN
 HfO₂
 HfO₂ 2
 HfSiO₄
 InSbO
 IrO₂
 LaF₃
 LiCaAlF₆
 LiF
 LiNbO₃
 LiTaO₃ congruent
 LiTaO₃ stoichiometric
 Lu₃Al₅O₁₂
 Mg doped LiTaO₃
 MgAl₂O₄ (spinel)
 MgF₂
 MgO
 Nb₂O₅
 NbN
 NdF₃
 RuO₂
 Sc₂O₃
 Si₃N₄
 SiN (anti reflective coating)

SiO
 SiO₂
 SiO₂ (therm)
 SiON
 SiOx
 SrTiO₃
 Ta₂O₃
 Ta₂O₅
 TaSi₂
 TaSi₂ 2
 TeO₂
 TEOS
 TiN
 TiO₂
 TiO₂ 2
 TiO₂ 3
 TiSi₂
 V₂O₅
 VO₂
 VSi
 VSi 2
 Y₂O₃
 Y₃Al₅O₁₂ (YAG)
 ZnO
 ZrN
 ZrO₂

Glasses

2.1% fluorine fused silica
 2.6% fluorine fused silica
 3.7% fluorine fused silica
 BK7
 BPSG
 BSG (Boron silica glass)
 Corning 1737F
 CORNING 7059
 Corning EAGLE XG
 CR-39
 D263
 FTO
 Fused Germania
 Fused Silica
 HOYA
 HOYA BAC4
 HOYA BACD11
 HOYA BACD14
 HOYA BACD15
 HOYA BACD16
 HOYA BACD18
 HOYA BACD2
 HOYA BACD4
 HOYA BACD5
 HOYA BACED5
 HOYA BAF10
 HOYA BAF11
 HOYA BAFD7
 HOYA BAFD8
 HOYA BSC7

HOYA E-ADF10
 HOYA E-ADF50
 HOYA E-BACD10
 HOYA E-BACED20
 HOYA E-BAF8
 HOYA E-C3
 HOYA E-CF6
 HOYA E-F1
 HOYA E-F2
 HOYA E-F3
 HOYA E-F5
 HOYA E-F8
 HOYA E-FD1
 HOYA E-FD10
 HOYA E-FD13
 HOYA E-FD15
 HOYA E-FD2
 HOYA E-FD4
 HOYA E-FD5
 HOYA E-FD7
 HOYA E-FD8
 HOYA E-FD80
 HOYA E-FDS1
 HOYA E-FDS2
 HOYA E-FDS3
 HOYA E-FEL1
 HOYA E-FEL2
 HOYA E-FEL6
 HOYA E-FL5
 HOYA E-FI6
 HOYA E-LAF7
 HOYA FC5
 HOYA FCD1
 HOYA FCD10
 HOYA FCD100
 HOYA FCD10A
 HOYA FCD1B
 HOYA FCD505
 HOYA FCD515
 HOYA FCD600
 HOYA FCD705
 HOYA FD110
 HOYA FD140
 HOYA FD225
 HOYA FD60
 HOYA FDS16-W
 HOYA FDS18
 HOYA FDS20-W
 HOYA FDS24
 HOYA FDS90
 HOYA FF8
 HOYA LAC10
 HOYA LAC12
 HOYA LAC13
 HOYA LAC14
 HOYA LAC7
 HOYA LAC8
 HOYA LAC9
 HOYA LACL60

HOYA LAF2
 HOYA LAF3
 HOYA LBC3N
 HOYA M-BACD12
 HOYA M-BACD15
 HOYA M-BACD5N
 HOYA M-FCD1
 HOYA M-FCD500
 HOYA M-FD80
 HOYA M-FDS2
 HOYA M-FDS910
 HOYA M-LAC130
 HOYA M-LAC14
 HOYA M-LAC8
 HOYA M-NBFD10
 HOYA M-NBFD130
 HOYA M-PCD4
 HOYA M-PCD51
 HOYA M-PCD55AR
 HOYA M-TAC60
 HOYA M-TAC80
 HOYA M-TAF101
 HOYA M-TAF105
 HOYA M-TAF31
 HOYA M-TAF401
 HOYA M-TAFD305
 HOYA M-TAFD307
 HOYA M-TAFD405
 HOYA M-TAFD51
 HOYA MC-NBF1
 HOYA MC-TAF1
 HOYA MP-FDS1
 HOYA MP-LAC8-30
 HOYA MP-LAF81
 HOYA NBF1
 HOYA NBFD10
 HOYA NBFD11
 HOYA NBFD12
 HOYA NBFD13
 HOYA NBFD15
 HOYA NBFD25
 HOYA NBFD29
 HOYA NBFD3
 HOYA NBFD30
 HOYA NBFD32
 HOYA PCD4
 HOYA PCD40
 HOYA PCD51
 HOYA TAC2
 HOYA TAC4
 HOYA TAC6
 HOYA TAC8
 HOYA TAF1
 HOYA TAF2
 HOYA TAF3
 HOYA TAF4
 HOYA TAF5
 HOYA TAFD25
 HOYA TAFD30

HOYA TAFD32
 HOYA TAFD33
 HOYA TAFD35
 HOYA TAFD37
 HOYA TAFD40
 HOYA TAFD45
 HOYA TAFD55
 HOYA TAFD5F
 HOYA TAFD5G
 HOYA TAFD65
 LAFN7
 LZOS BF1
 LZOS BF11
 LZOS BF16
 LZOS BF21
 LZOS BF24
 LZOS BF25
 LZOS BF28
 LZOS BF8
 LZOS BK10
 LZOS BK4
 LZOS BK6
 LZOS BK8
 LZOS CTK12
 LZOS CTK19
 LZOS CTK3
 LZOS CTK8
 LZOS CTK9
 LZOS F1
 LZOS F13
 LZOS F4
 LZOS F6
 LZOS F8
 LZOS K8
 LZOS KF6
 LZOS KF7
 LZOS LF5
 LZOS LF7
 LZOS LF9
 LZOS LK3
 LZOS LK5
 LZOS LK6
 LZOS LK7
 LZOS OF1
 LZOS OK4
 LZOS TF1
 LZOS TF10
 LZOS TF2
 LZOS TF3
 LZOS TF4
 LZOS TF5
 LZOS TF7
 LZOS TF8
 LZOS TK12
 LZOS TK14
 LZOS TK16
 LZOS TK17
 LZOS TK2
 LZOS TK20
 LZOS TK21
 LZOS TK23
 LZOS TK9
 Microscope slide
 N-BAF10
 N-BK10
 N-BK9
 N-FK5

N-LAF2
 OHARA BAL15Y
 OHARA BAL35
 OHARA BAL35Y
 OHARA BAL42
 OHARA BSL7Y
 OHARA BSM51Y
 OHARA L-BSL7
 OHARA L-LAH53
 OHARA L-LAH81
 OHARA L-LAH83
 OHARA L-LAH84
 OHARA L-LAL12
 OHARA L-LAM60
 OHARA L-NBH54
 OHARA L-PHL1
 OHARA L-TIH53
 OHARA L-TIM28
 OHARA PBH56
 OHARA PBL1Y
 OHARA PBL25Y
 OHARA PBM18Y
 OHARA PBM2Y
 OHARA S-BAH10
 OHARA S-BAH27
 OHARA S-BAH28
 OHARA S-BAH32
 OHARA S-BAL 2
 OHARA S-BAL12
 OHARA S-BAL35
 OHARA S-BAM 3
 OHARA S-BAM 4
 OHARA S-BAM12
 OHARA S-BSL 7
 OHARA S-BSM 2
 OHARA S-BSM18
 OHARA S-BSM25
 OHARA S-FPL51
 OHARA S-FPL52
 OHARA S-FPL53
 OHARA S-FSL 5
 OHARA S-FTL10
 OHARA S-FTM16
 OHARA S-LAH52
 OHARA S-LAH55
 OHARA S-LAH58
 OHARA S-LAH66
 OHARA S-LAH79
 OHARA S-LAL 7
 OHARA S-LAL 8
 OHARA S-LAL61
 OHARA S-LAM 2
 OHARA S-LAM51
 OHARA S-LAM66
 OHARA S-NBH 5
 OHARA S-NBH 8
 OHARA S-NBH51
 OHARA S-NBH55
 OHARA S-NPH 1
 OHARA S-NPH 2
 OHARA S-NPH53
 OHARA S-NSL 3
 OHARA S-PHM52
 PSG
 Pyrex
 Quartz
 SCHOTT BASF51

SCHOTT Borofloat 40
 SCHOTT F2
 SCHOTT F4
 SCHOTT F5
 SCHOTT K10
 SCHOTT K7
 SCHOTT KZFSN5
 SCHOTT LAFN7
 SCHOTT LAK L12
 SCHOTT LAK N13
 SCHOTT LASFN9
 SCHOTT LF5
 SCHOTT LLF1
 SCHOTT N-BAF10
 SCHOTT N-BAF3
 SCHOTT N-BAF4
 SCHOTT N-BAF51
 SCHOTT SF11
 Sodalime
 ZERODUR

Metals

Ag
 AgI
 Al
 Al_sopra
 AlSiCu
 Au_Johnson
 Au_palik
 Au_Yakubovsky (25nm)
 Au_Yakubovsky (50nm)
 Be
 Brass (Cu-Zn alloy)
 Co
 CoFe
 CoSi2
 Cr
 Cu
 Fe
 Hg
 Ir
 Li
 MnPt
 Mo
 Nb
 Ni
 NiFe
 NiFeCo
 NiP
 NiSi
 Os
 Pd
 Pt
 Re
 Rh
 Sn
 Stainless Steel
 Ta
 Ti
 V
 W
 Y
 Zn
 Zr

Misc

a-C
 Air
 AlSi
 AlSiTi
 AZO (Al-doped zinc oxide)
 Bi12SiO20
 C18H19N - 4-Cyano-4'-
 pentylbiphenyl
 CCl4
 Diamond
 DLC (Diamond Like Carbon)
 DNA
 DNA - CTMA
 Graphene
 Inq3 - Tris(8-
 hydroxyquinoline) indium
 ITO
 ITO 2
 ITO 3
 ITO 4
 KBr
 KCl (Potassium Chloride)
 KDP
 LC (Liquid Crystal)
 Liquid Crystal - 5CB
 Liquid Crystal - 5PCH
 Liquid Crystal - E44
 Liquid Crystal - E7
 Liquid Crystal - MLC-6241-
 000
 Liquid Crystal - MLC-6608
 LC - MLC-9200-000
 LC- MLC-9200-100
 LC - TL-216
 MoO3
 MoOx
 MoS2
 MoSe2
 MoSi2
 NaCl
 NCD (NanoCryst Diamond)
 NPB
 PCE (Tetrachloroethene)
 PZT
 Rhodamine 560
 RTC
 ThF4 (Thorium tetrafluoride)
 Ti6Al4V
 TiAlC
 TiAlCN
 TiAlSiCN
 TiAlSiCO
 TiAlSiO
 TiC
 VC - Vanadium carbide
 VN - Vanadium Nitride
 W3N2
 WO2.5N0.9
 WO2.6N0.6
 WO2.8N0.5
 WSi2
 ZnOI

Polymers

Acrylic [Plexiglass]
 Bayer
 CD dye
 Cellulose
 Cellulose 2
 CTE Richardson
 CYTOP
 EPR (Epoxy Resist)
 EPR x-linked
 EVA- Ethylene-vinyl acetate
 Gelatin
 Loctite 3526
 LTC 9300 (PI)
 NAS-21
 NdBR
 Norland NOA 1348
 Norland NOA 170
 Norland NOA 61
 Optorez 1330
 P3HT
 P3HT-PC61BM
 Parylene C - Thick
 Parylene C - Thin
 Parylene D
 Parylene N
 PC (Polycarbonate)
 PDMS
 PDMS 2
 PDMS 3
 PE (Polyethylene)
 PEDOT:PSS
 PEI (Polyetherimide)
 PEMA
 PEN
 PET
 PFHE
 PFN
 PHEMA
 PHEMA-TPS
 PI (Polyimide)
 PLA
 PMMA
 PMMA 495
 PMMA 950
 PNIPAM
 Poly Acrylate
 PP (Polypropylene)
 PPDT2FBT
 PS (Polystyrene)
 PS 2 (Polystyrene)
 PTFE [AF1300]
 PTFE [AF1601]
 PTFE [AF2400]
 PVA (Polyvinyl alcohol)
 PVA cured
 PVC (Polyvinyl chloride)
 PVP (Polyvinylpyrrolidone)
 S-low Styrene
 Styrene
 Styrene - acrylonitrile
 Sylgard 184 (Silicon)
 Zeonex E48R

Resists

APEX-E
 APOL- LO 3200

AR 2600DUV
 AR-BR5460
 AR-N 2220
 AR-N 4240 exp
 AR-N 4240 unexp
 AR-N 4340 exp
 AR-N 4340 unexp
 AR-N 4400
 AR-N 4600
 AR-N 750
 AR-N 7500
 AR-N 7520
 AR-N 7700 crosslinked
 AR-N 7700 no crosslinked
 AR-N 7720 crosslinked
 AR-N 7720 no crosslinked
 AR-P 1220
 AR-P 3100
 AR-P 3210
 AR-P 3540T
 AR-P 3740
 AR-P 5300
 AR-P 5910
 AR-P 617
 AR-P 6200
 AR-P 631-679
 AR-P 6510
 AR-P 7400
 AR-P 8100
 AR-PC 500
 AR-PC 503
 AR-PC 504
 AR-U 4000 exp
 AR-U 4000 unexp
 AZ 111 exp
 AZ 111 unexp
 AZ 125nXT unbleached
 AZ 1350H exp
 AZ 1350J exp
 AZ 1350J unexp
 AZ 1450 exp
 AZ 1450 unexp
 AZ 1500 bleached
 AZ 1500 unbleached
 AZ 1518
 AZ 1518 (SFD)
 AZ 15nXT unbleached
 AZ 2400 exp
 AZ 2400 unexp
 AZ 3027 bleached
 AZ 3027 unbleached
 AZ 40XT unbleached
 AZ 4500
 AZ 4620
 AZ 520D unbleached
 AZ 5214E bleached
 AZ 5214E unbleached
 AZ 6112
 AZ 6200 bleached
 AZ 6200 unbleached
 AZ 6210B
 AZ 6270 DX
 AZ 6600 bleached
 AZ 6600 unbleached
 AZ 7209
 AZ 7510
 AZ 7700 bleached

AZ 7700 unbleached
 AZ 9200 bleached
 AZ 9200 unbleached
 AZ Aquatar
 AZ BARLi
 AZ MiR 701 bleached
 AZ MiR 701 unbleached
 AZ MiR 703 exp
 AZ MiR 703 unexp
 AZ NOVA 2071
 AZ P4110
 AZEL2015
 CE7000
 COP E.B exp
 COP unexp
 Diaplate132
 EL 2015 Ultramac
 EpoClad exp
 EpoClad unexp
 EpoCore exp
 EpoCore unexp
 GKRS
 HD-8820 cured
 HD-8820 developed
 HPR-204 exp
 HPR-204 unexp
 HPR-206 exp
 HPR-206 unexp
 InkOrmo hardbake
 InkOrmo no hardbake
 IP-Dip
 IP-G
 IP-L
 IP-S
 IP3600- E
 IP3600- UE
 JSR THB-151N
 K-PRO
 KL 5300
 KL 6000
 KL NPR
 KMPR 1000
 Kodak 809 exp
 Kodak 809 unexp
 Kodak 820 exp
 Kodak 820 unexp
 KTRF Kodak thin film resist
 KTRF Kodak thin film resist
 unexp
 LOR-A
 LOR-B
 M82_Medusa
 ma-N 1400 exp
 ma-N 1400 unexp
 ma-N 2400 exp
 ma-N 2400 unexp
 ma-N 405 exp
 ma-N 405 unexp
 ma-N 440 exp
 ma-N 440 unexp
 ma-N 490 exp
 ma-N 490 unexp
 ma-P 1275 G unexp
 ma-P 1275 HV unexp
 MegaPosit SPR220
 MegaPosit SPR3600

Microposit S1800
 mr-DWL exp
 mr-DWL unexp
 mr-EBL 6000 exp
 mr-EBL 6000 unexp
 mr-I 7000
 mr-I 8000
 mr-I 9000 M
 mr-I PMMA
 mr-NIL 6000 E
 mr-T 85
 mr-UVCur06
 mr-UVCur21
 mr-UVCur21SF
 mr-UVCur26SF
 mr-UVL 6000 exp
 mr-UVL 6000 unexp
 OFPR-800 Dynachem
 Ormocer
 OrmoClad
 OrmoClear
 OrmoComp hardbake
 OrmoComp no hardbake
 OrmoCore
 OrmoStamp
 PermiNex 1000
 PermiNex 2000
 PFI88A5- E
 PFI88A5- UE
 PMGI
 PW1000T
 SiPOL
 SML
 SPR2FX13
 SPR2FX13JL
 SPR2FX13JM
 SPR3000
 SPR3500
 SPR500A
 SPR700
 SPR850
 SPR900
 SPR950
 SPR955-CM
 SU-8
 SU-8 2000
 SU-8 3000
 SU-8 Gersteltec
 SYSTEM8
 THMR-iP3500 HP
 UV2HS DUV
 UV3 DUV
 UV5 DUV
 UV6 DUV
 ZEP520A

Semiconductor

2D HOIP (Hybrid org-in per)
 a-Si
 a-Si 2
 a-Si 3
 AIN
 Al0.099Ga0.901As
 Al0.135Ga0.685As
 Al0.198Ga0.802As
 Al0.419Ga0.581As

Al_{0.491}Ga_{0.909}As
 Al_{0.59}Ga_{0.41}As
 Al_{0.7}Ga_{0.3}As
 Al_{0.804}Ga_{0.196}As
 AlAs
 AlAs_sopra
 AlCu
 AlCu 2
 AlGaAs
 AlSb
 As₂Se₃
 Bi₂Se₃
 CdS
 CdS 2
 CdSe
 CdTe
 CH₃NH₃PbBr₃
 CH₃NH₃PbBr₃ perovskite
 CH₃NH₃PbI₃
 CH₃NH₃PbI₃ Perovskite
 CIGS - Cu[In(1-x),Ga(x)]Se₂
 Cs₂AgBiBr₆
 CsPb(Br,Cl)₃
 CsPbBr₃
 CsPbCl₃
 CsPbI₃
 Ga₂O₃
 GaAn
 GaAs

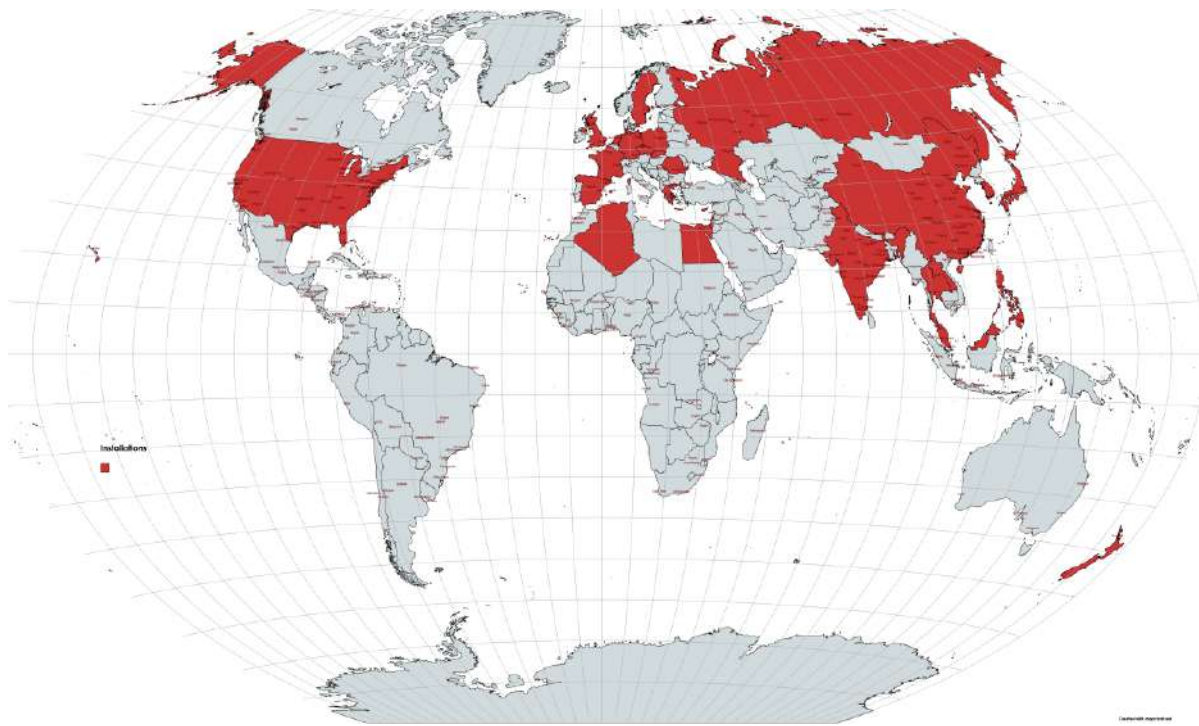
GaAs (111)
 GaInAs
 GaInP
 GaN
 GaN 2
 GaP
 GaSb
 Ge
 Ge Amorphous
 Hg₁Cd₀Te
 HgCdTe₂
 HgCdTe₃
 HgTe
 In₁Ga₀Sb
 In₂O₃
 InAs
 InAsO
 InGaAs
 InGaAs_{0.24}P_{0.76}
 InGaAs_{0.42}P_{0.58}
 InGaAs_{0.55}P_{0.45}
 InGaAs_{0.82}P_{0.18}
 InGaP
 InP
 InPO
 InSb
 InSe
 IZO amorphous
 NiMn₂O₄

p-Si
 p-Si (Large Grain)
 p-Si (Small Grain)
 p-Si-Brugg
 PbS
 PbSe
 PbTe
 PtSe₂
 PZT
 RsB
 Si
 Si (100)
 Si (110)
 Si Porous
 SiC
 SiC 2
 SiC 3
 SiGe
 SnO
 SnO₂
 SnO₂ 2
 TiN 2
 WO₃
 WS₂
 WSe₂
 Zn₁Cd₀Te
 ZnCdTe₀
 ZnCdTe₅
 ZnS

ZnS 2
 ZnSe
 ZnSe₀Te₁
 ZnSeTe₅
 ZnTe

Solvents

1,2-Dichlorethane
 1,4 Dioxane
 1,5-Pentanediol
 1-Butanol
 1-Pentanol
 1-Propanol
 Acetone
 Acetonitrile
 Amyl alcohol
 Benzene
 Carbon tetrachloride
 Cyclohexane
 Ethanol
 Isoamyl Alcohol
 Isobutanol
 Methanol
 Sea Water
 Toluene
 Water



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