Objective lenses

Objective lenses	W.D.(mm)	NA
5×	23.50	0.15
10×	17.50	0.30
20×	4.50	0.45
50×	1.00	0.80
100×	1.00	0.90
150×	1.50	0.90

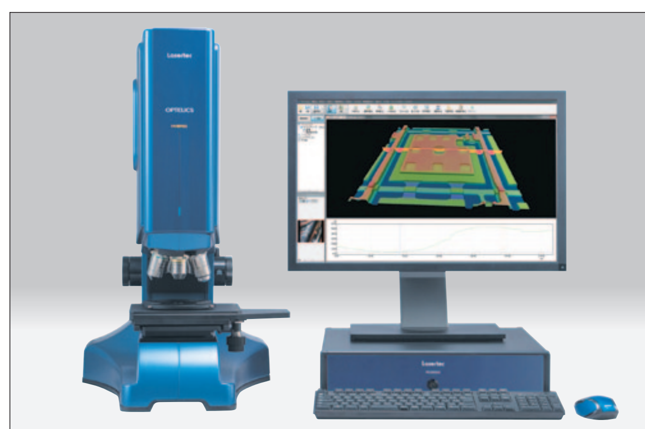
Objective lenses (high NA)	W.D.(mm)	NA
50 × Apo	0.35	0.95
100× Apo	0.32	0.95

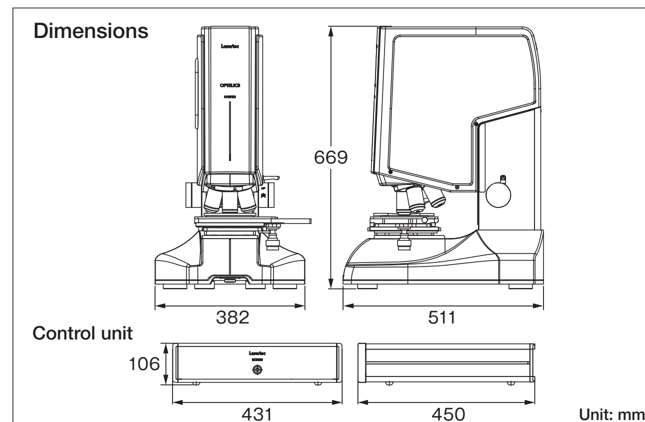
Special objective lenses (high NA)	W.D.(mm)	NA
5 × LT	10.50	0.25
10× LT	1.60	0.50
20× LT	0.70	0.75

CFI60 objective lenses

Special objective lenses (high NA)

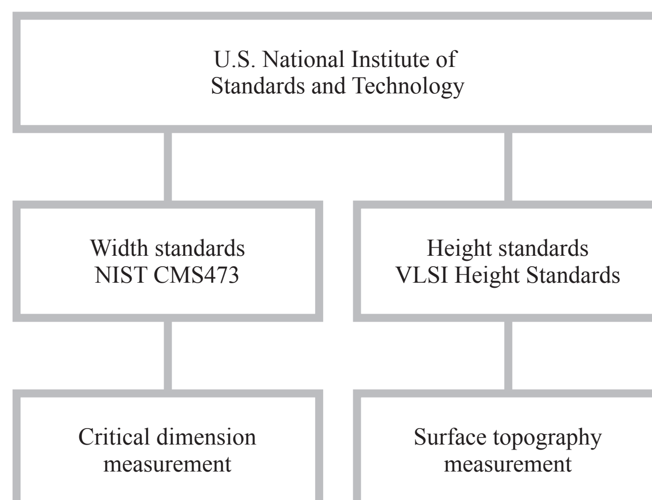
Exterior





Traceability diagram

Calibration of OPTELICS HYBRID is performed in conformance to the measurement standards traceable to the national standards:



Lasertec HQ was certified ISO9001:2008 in June 2009.

Laser radiation
Do not look into a laser beam.
405nm continuous wave with 100μW maximum
Class 2 laser product
JIS C 6802 : 2011

⚠ Safety precautions: Read manuals before use and use the product correctly.

- This catalog provides information as of June 2013.
- The contents of this catalog are compiled from the information available to Lasertec as of the release date.
- Specifications of the product are subject to change without notice.
  Neither the manufacturer nor the seller assumes any responsibility for damages incurred by users due to specification change.
- Screen images are simulated.

Lasertec Corporation

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Homepage	http://www.Lasertec.co.jp/
E-mail	Sales@Lasertec.co.jp

13/11-02

Lasertec

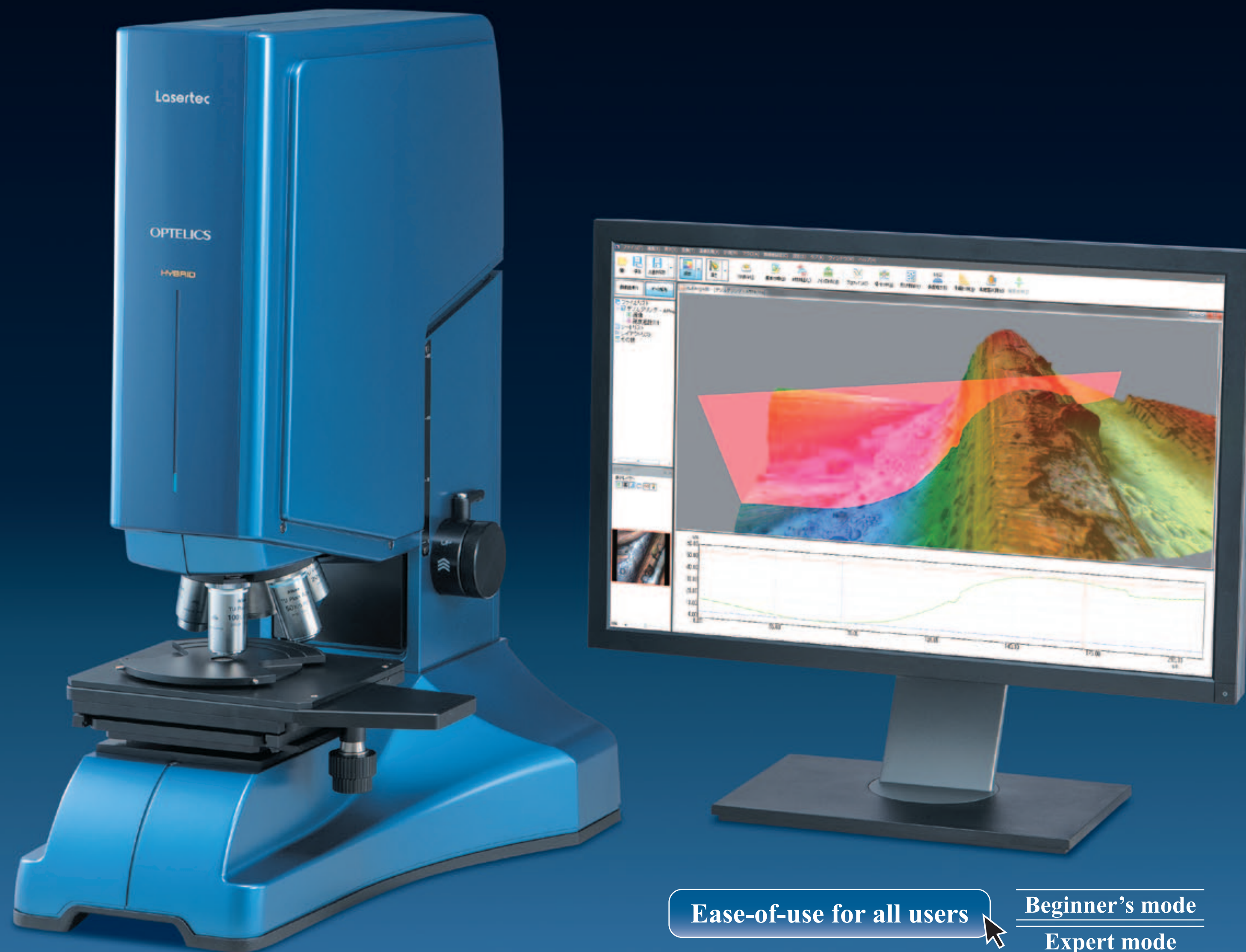
HYBRID LASER MICROSCOPE

OPTELICS®
HYBRID

Confocal scanning laser microscope of the next generation

HYBRID LASER MICROSCOPE

OPTELICS HYBRID



Ease-of-use for all users — Beginner's mode / Expert mode

High skills for all users — Macro mode

Laser + Color Confocal

This is the world's first microscope that integrates optical technologies of both confocal scanning laser microscope and full-color confocal microscope in one body. The "hybrid" microscope attains the highest versatility ever.

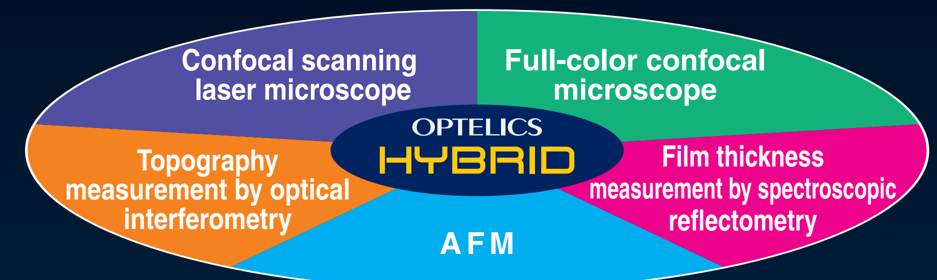
Confocal scanning laser microscope

- High magnification and high resolution
- Highly accurate 3D measurement

Full-color confocal microscope

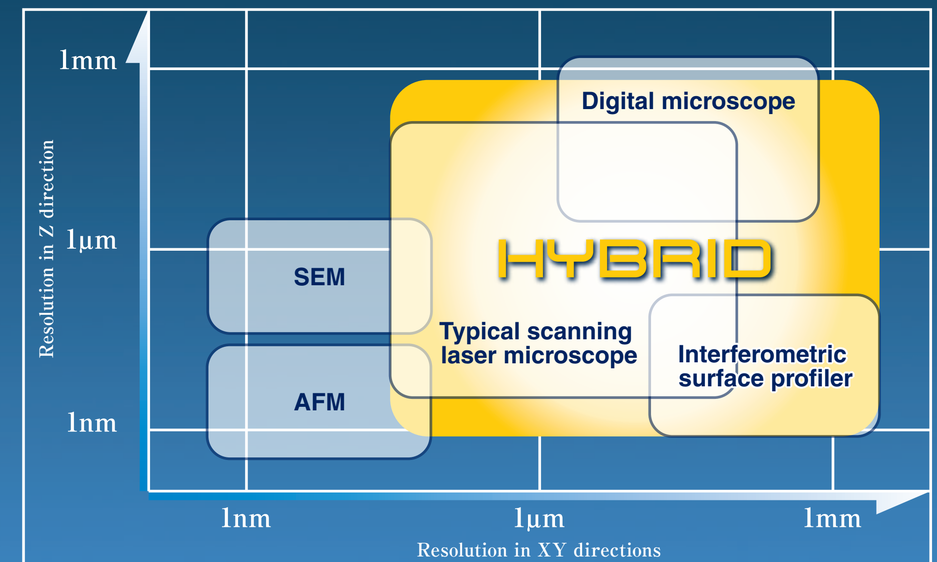
- Wide FOV
- Real color
- Many applications

All-in-One



With these 5 functions complementing each other, HYBRID OPTELICS covers a wide range of observation and measurement needs.

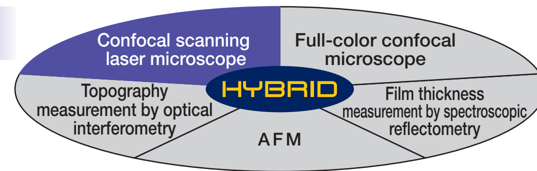
"Wider and higher" areas can be measured with high accuracy



World's first microscope integrating optical technologies of
Scanning Laser Microscope + Full-color Confocal Microscope

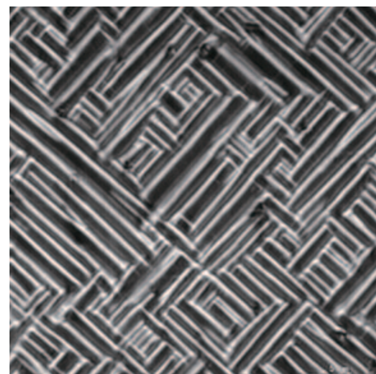
Laser + Color Confocal

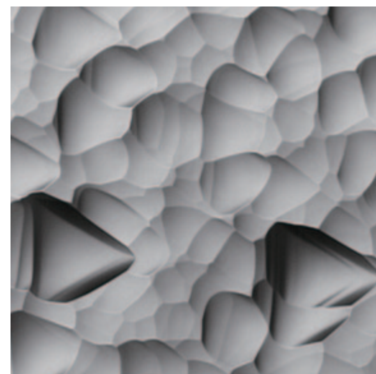
Scanning laser microscope

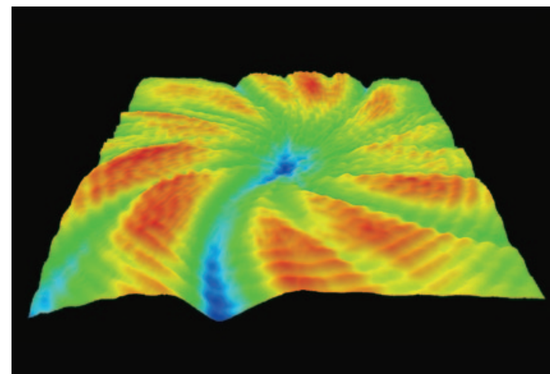


High magnification and high resolution observation

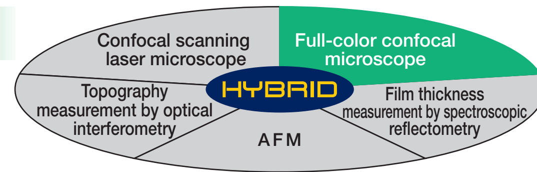
Furnished with a new 405nm laser light source, OPTELICS HYBRID provides clear images from non-contact observation of extremely small structures in the nanometer-scale world.


Sodium niobate domain (FOV 25μm)


Si wafer backside (FOV 75μm)

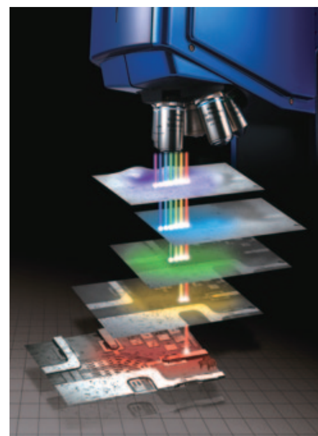

3D image of spherulitic polymer blends (FOV 150μm)

Full-color confocal microscope



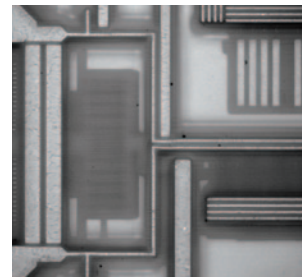
Wavelength selection for wider applications

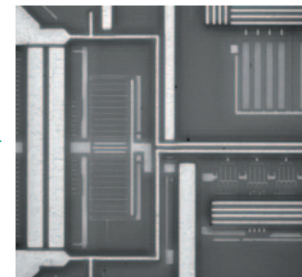
6 selectable wavelengths for optimal observation and measurement of samples in diverse applications


Concept of multilayer observation based on wavelength selection

A different observation result from each wavelength

Observation of shallow part by 436nm


Observation of middle part by 546nm

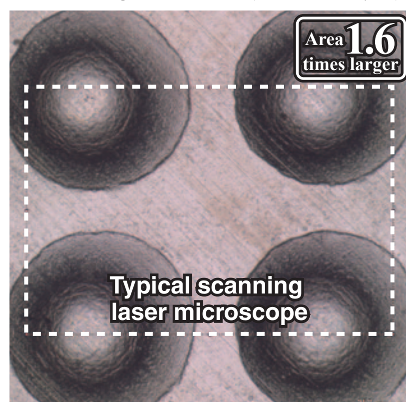

Observation of deeper part by 630nm

Communication device with PI coating

Wide field of view for higher efficiency

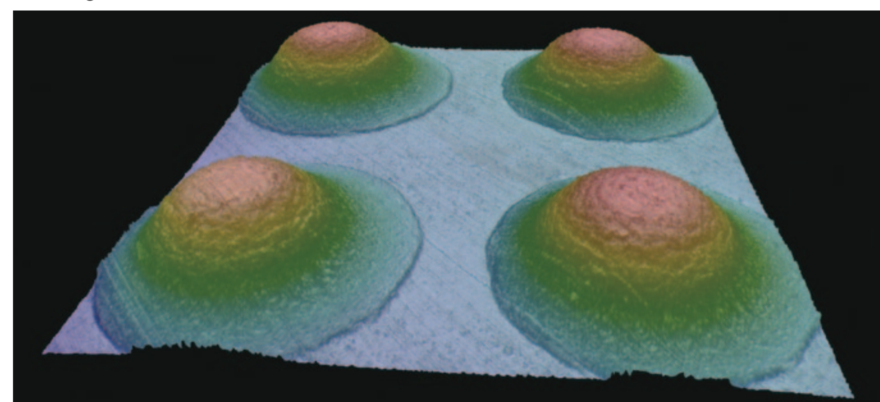
OPTELICS HYBRID has an approximately 1.6 times wider field of view than a typical scanning laser microscope. *If a lens of equal magnification is used.

10x image of surface (FOV 1,500μm)



Terminals

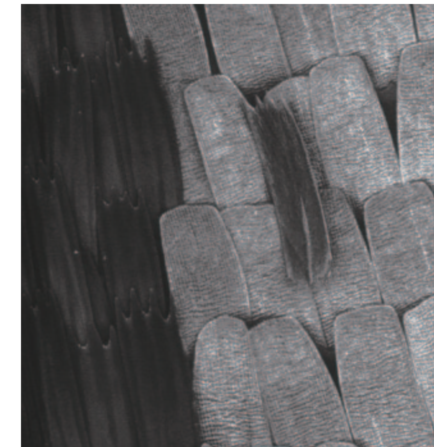
3D image



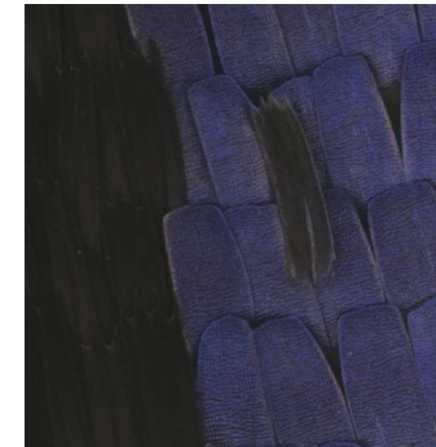
High-resolution full-color confocal observation

OPTELICS HYBRID uses a xenon lamp, which produces a spectrum of light similar to that of sunlight. Full-color confocal provides high resolution images with good color separation and high depth of field.

A grayscale image of scanning laser microscope


Scales of butterfly

A color image of scanning laser microscope


Synthesized with non-confocal color image

A full-color image of OPTELICS HYBRID

High resolution image provided by full-color confocal

Observation of small bumps and dents in the nanometer scale

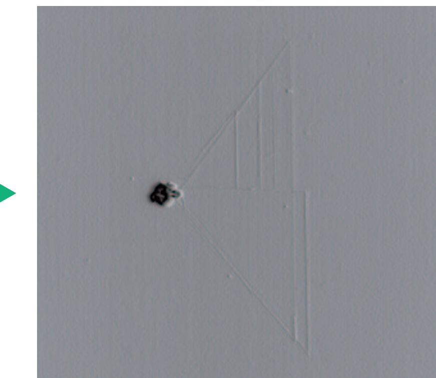
OPTELICS HYBRID visualizes small bumps and dents on samples by the combined use of confocal and differential interference (DIC) optics.

Epi defect on SiC wafer (FOV 1,500μm)

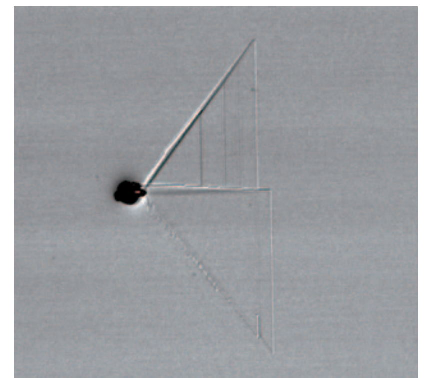
Without DIC

Small bumps and dents not visible

Digitally-processed DIC


Small bumps and dents not clearly visualized

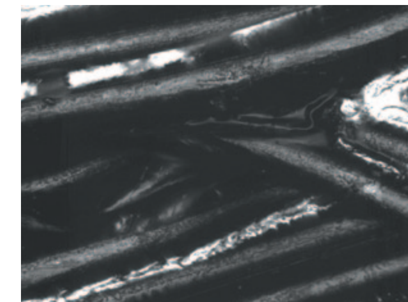
Optical DIC by OPTELICS HYBRID


Small bumps and dents clearly visualized

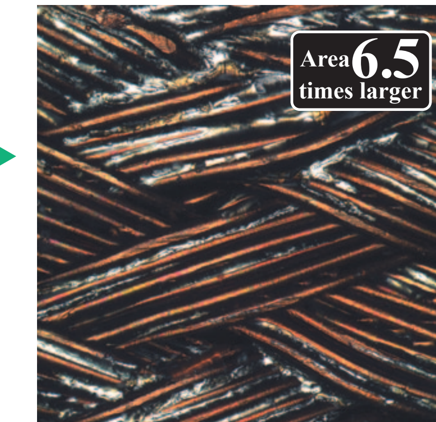
High FOV and high resolution achieved at the same time

The resolution provided by OPTELICS HYBRID with a 10x objective lens is better than the resolution of a typical scanning laser microscope with a 20x objective lens.

A typical scanning laser microscope image with 20x NA0.46


Copper wire (FOV 670μm×500μm)

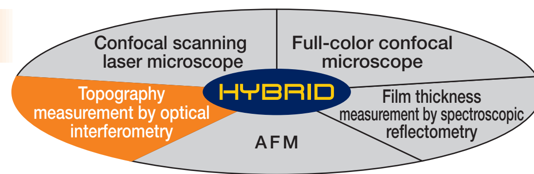
A wide FOV high resolution image provided by OPTELICS HYBRID with 10x NA0.50



(FOV 1,500μm)

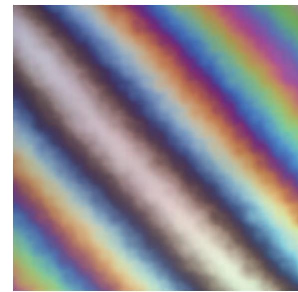
Industry-leading measurement accuracy

Topography measurement by optical interferometry



Measurement of thin films on extremely small patterns

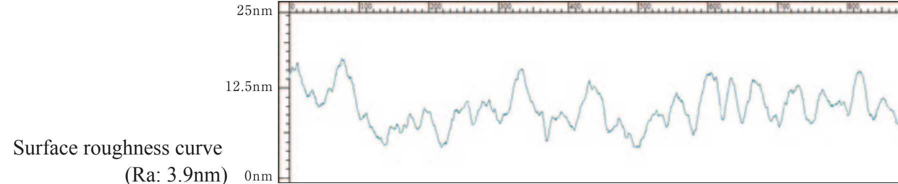
OPTELICS HYBRID has an optical interference measurement function using white light, offering nanometer-level accuracy for measurement of a millimeter-scale area. No scanning laser microscopes can match this capability.



Interferometer image of GaN Epi film

■ Highly accurate 3D measurement with wide FOV

Roughness evaluation of GaN Epi film (FOV 1mm)



Surface roughness curve (Ra: 3.9nm)

Film thickness measurement by spectroscopic reflectometry

Confocal scanning laser microscope
Full-color confocal microscope
HYBRID
Topography measurement by optical interferometry
Film thickness measurement by spectroscopic reflectometry
AFM

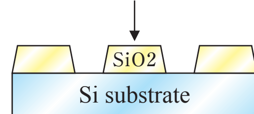
Measurement of transparent thin films

OPTELICS HYBRID measures the thickness of transparent films based on the wavelength selection function. Measurement can be made over a user-specified area on a non-patterned or patterned surface.

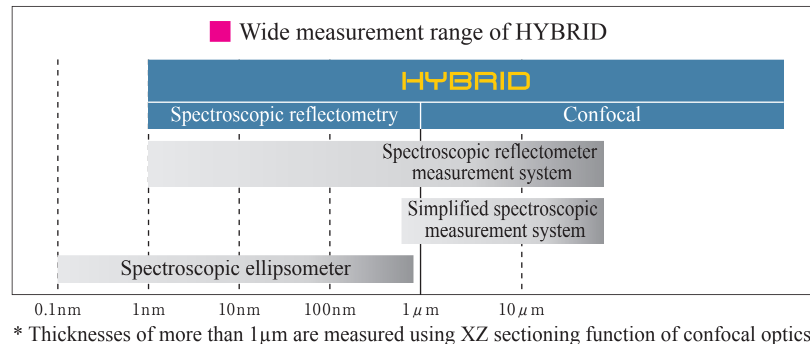
Main applications

- Oxide films
- SOI multilayer films
- Other transparent films
- Etching residues

Thin film measurement over a very small area is possible.

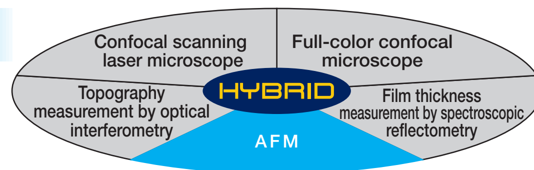


■ Wide measurement range of HYBRID



* Thicknesses of more than 1μm are measured using XZ sectioning function of confocal optics.

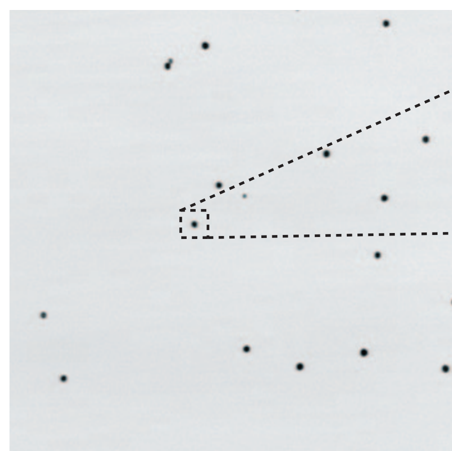
AFM Atomic Force Microscope (Option)



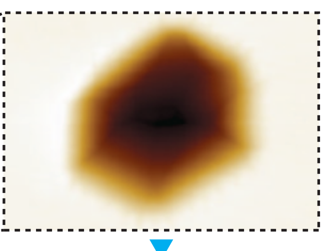
3D analysis of nanometer-scale structures

OPTELICS HYBRID performs highly accurate 3D measurement of extremely small structures in the nanometer scale. Confocal optics cannot match this capability.

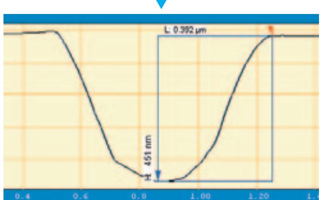
■ Confocal image



■ AFM image



Pit on GaN Epi film (width 300nm, depth 300nm)



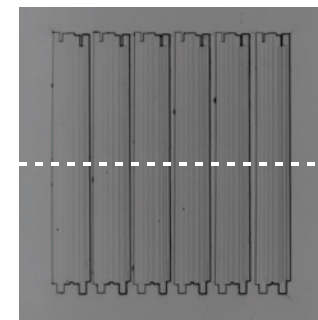
Profile

Basic measurement functions

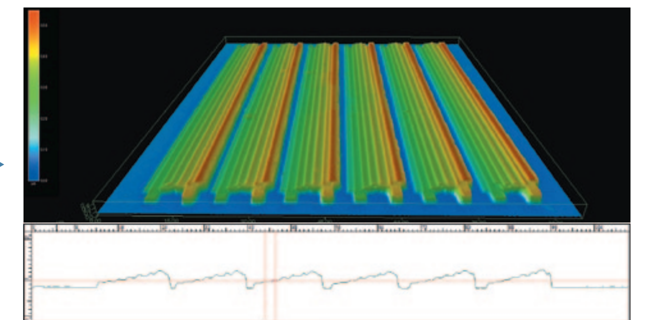
Height difference measurement

OPTELICS HYBRID measures height differences with industry-leading accuracy and measurement repeatability.

■ Accuracy: ±(0.11+L/100) μm
■ Repeatability: σ =0,01μm



Nanoimprint mold

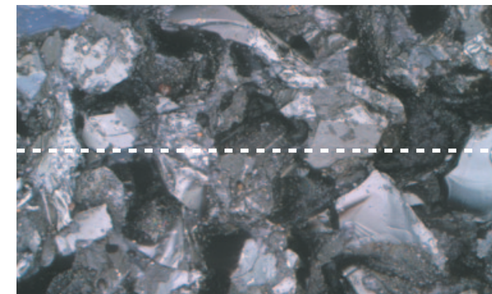


3D profile / Step height : 45nm

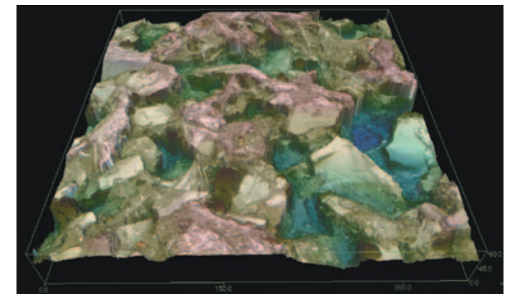
Surface roughness measurement

OPTELICS HYBRID conforms to JIS and ISO parameters for surface roughness measurement. Highly accurate roughness measurement can be made regardless of sample types thanks to non-contact measurement.

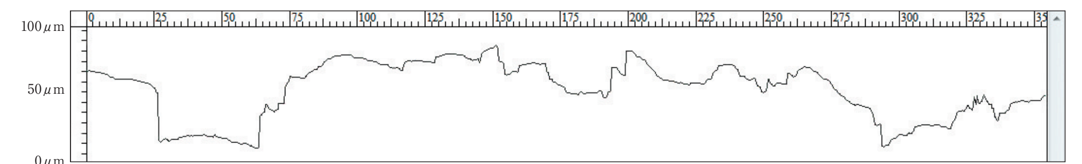
■ Line roughness: Ra, Rz, Rp, Rv, etc.
■ 3D roughness: Sa, Sz, Sp, Sv, etc.



Diamond grinding stone



3D image

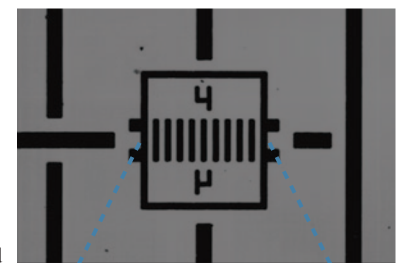


Profile of cross section at measurement line (dotted line)

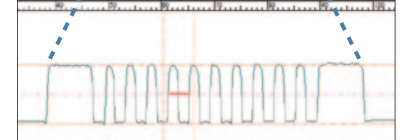
Line width measurement

An excellent tool to measure the line width of semiconductor patterns and others, OPTELICS HYBRID achieves industry-leading accuracy and measurement repeatability based on unique optical and detector designs.

■ Accuracy: ±【 0.02× (100/ magnification of objective lens) + L/1000 】μm
(Example: ±0.02μm for a line width of 5μm)
■ Repeatability: 3 σ =0,01μm



Line width standard

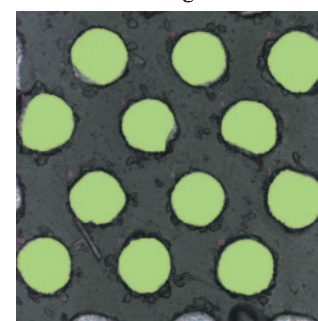


Graph of brightness

Analysis of geometric properties

OPTELICS HYBRID analyzes more than 20 properties including area, volume, center of gravity, etc. Output of analysis result is available in a spreadsheet format

■ Binarized image



Bumps

	Area	Volume	Maximum height
No. 1	17037.588	70413.92	6.6
No. 2	18619.303	63011.302	6.924
No. 3	16053.775	56333.613	5.431
No. 4	16992.801	71030.903	6.489
No. 5	15471.548	62414.267	6.174
Maximum	18619.303	71030.903	6.956
Minimum	15471.548	38180.167	4.062
Total	200524.013	691960.245	71.52
Average	16710.334	57663.354	5.96
Standard deviation	952.076	11291.086	0.919

Analysis result

HYBRID means Quick and Stress-free

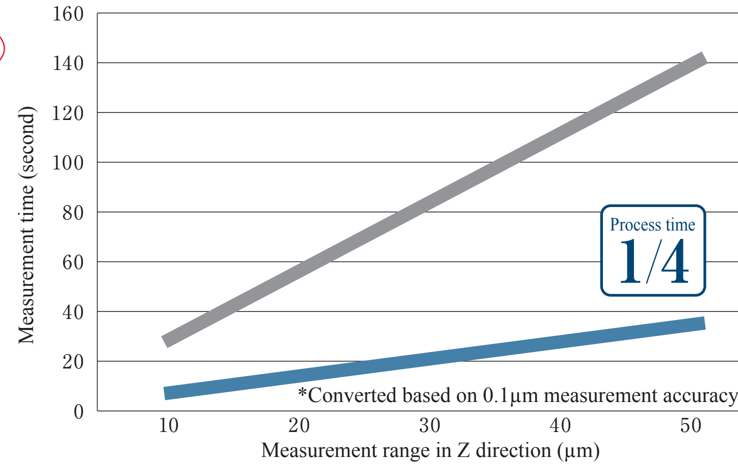
High speed, stress-free operation

Highest frame rate in the industry

High speed auto measurement

OPTELICS HYBRID is capable of scanning at the industry-leading rate of 15 frames per second or about 4 times faster than a typical scanning laser microscope. OPTELICS HYBRID is a powerful tool for high-speed auto measurement and high-speed motion observation.

Industry-leading speed



HYBRID

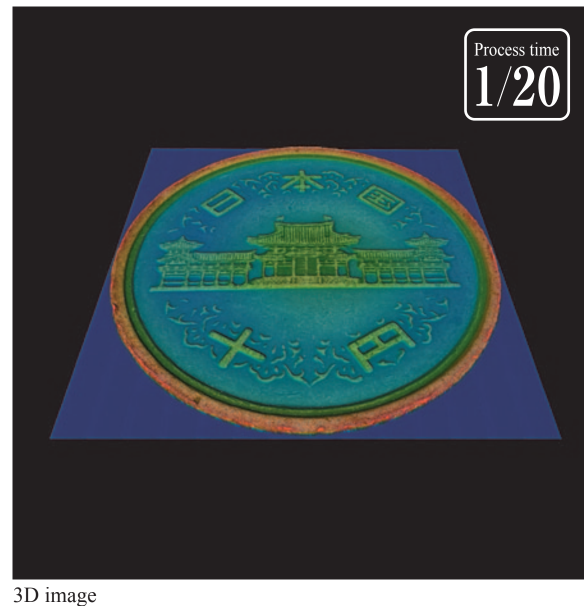
Typical scanning laser microscope

Patchwork speed far exceeding others

Patchwork is used to generate a wide FOV image by joining smaller images, allowing you to perform measurement of large samples with ease. OPTELICS HYBRID needs only 1/20 of the time required by a typical scanning laser microscope to generate a patchwork image of equal size because OPTELICS HYBRID requires a fewer images (1/5) and a shorter measurement time per image (1/4).

Patchwork by a typical scanning laser microscope

Patchwork by OPTELICS HYBRID
(diameter : 22nm) *The images above are illustrations.



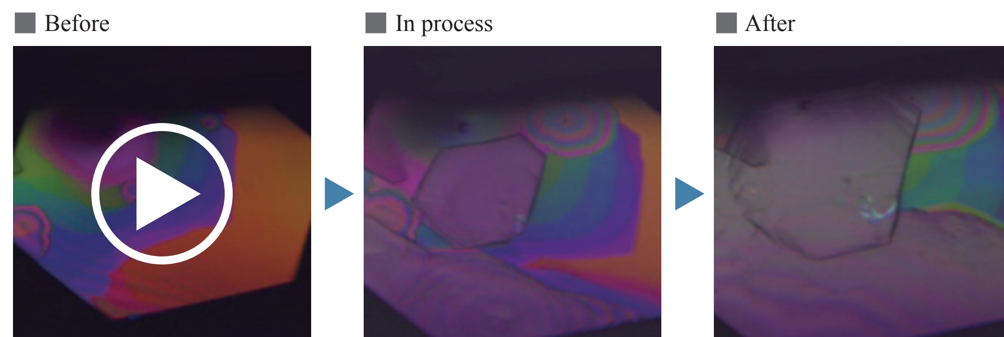
3D image

In-situ observation

High-speed, high resolution motion observation in oil immersion environment

Main applications

- In-situ observation of changes to metals and inorganic materials at high/low temperatures
- In-situ observation of crystal formations and phase transitions



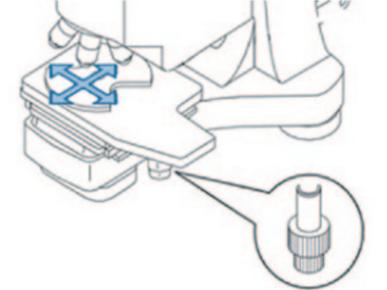
Crystal formation in cadmium iodine solution (High-speed high-resolution motion review of up to 15 frames per second is available).

HYBRID means Ease-of-Use and High Skills for All Users

User-friendly GUI for beginners and experts

Laser + Color Confocal

Expert mode and Beginner's mode



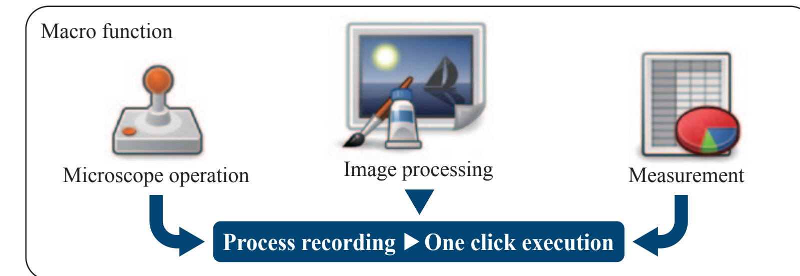
Expert Mode

You can make detailed settings and perform advanced operations.

Beginner's Mode

"Operation Guidance" walks you through operation of OPTELICS HYBRID step by step. You can complete measurement by simply following the instructions. It is a helpful tool for first-time users.

Macro function



You can use a macro with one click on the Play button.

Macro viewer

No.	Category	Description	Data
1	Control	Light path setting	Comma
2	Control	Auto focus	Commar
3	Control	Auto scan setting	Commar
4	Control	Z scan	Commar
5	Filter	Median	Commar
6	Geometrical conversion	Horizontal correction	BaseOff
7	Measurement	Profile measurement	AddExist
8	Measurement	Roughness measurement	AddExist
9	File	Save (image)	Commar

Expert operator

You can save a sequence of measurement and/or analysis in a macro, which records commands as they are executed.

Operator

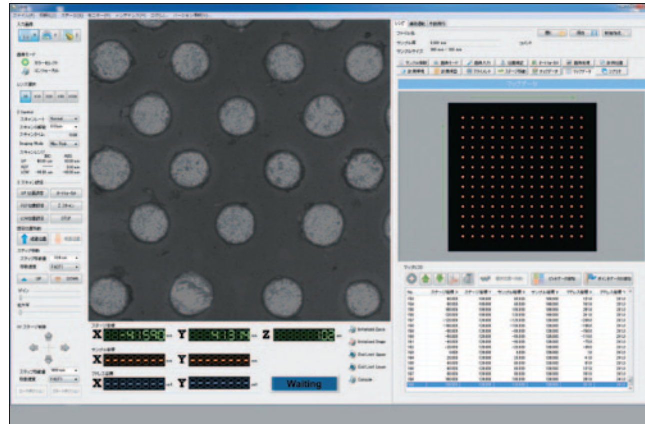
One click on a saved macro starts the sequence of processes and analyses just as executed by an expert operator.

For further enhancement of performance

Options

Auto-measurement software

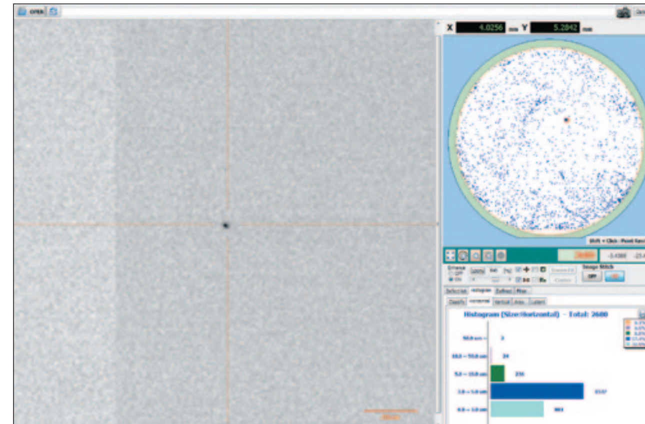
Our auto-measurement software and motorized stage together perform auto measurement of width, height and roughness of patterns on semiconductors and crystal substrates as specified by recipe.



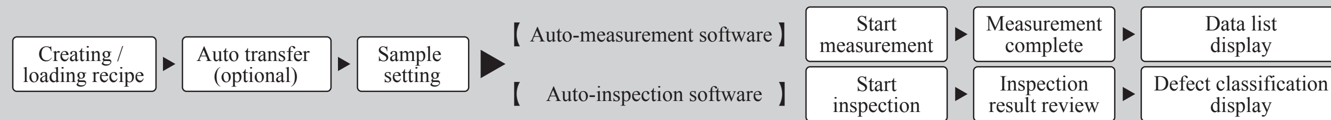
Auto measurement of bumps

Auto-inspection software

Our auto-inspection software enables you to perform fully-automated inspection of the entire surface of wafers, glass and other substrates to detect particles and defects. You can select, review and classify defects on a defect map using the auto-inspection software.



Entire surface inspection of 0.5µmPSL on wafer

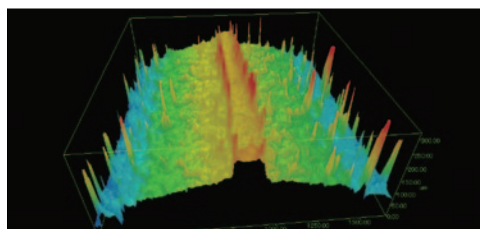


Special objective lenses optimized for wide FOV and highly accurate measurement

High NA lenses are available in 5x, 10x and 20x for highly accurate measurement even with low magnifications.

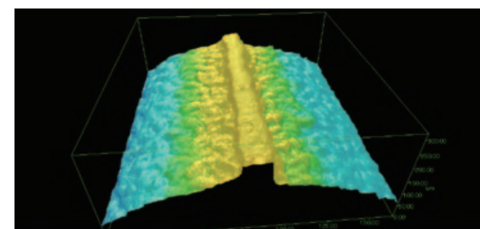
Magnification	General objective lens NA	Special objective lens NA	FOV
5×	0.15	0.25	3,000×3,000 µm
10×	0.30	0.50	1,500×1,500 µm
20×	0.45	0.75	750×750 µm

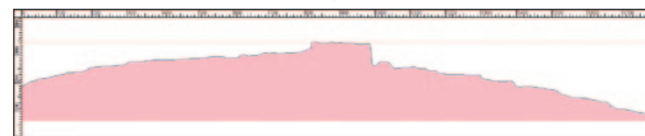
■ 3D image captured using a general objective lens (10x)



Profile data

■ 3D image captured using a high NA lens (10x) of OPTELICS HYBRID





Motorized stage

The motorized stage is used in conjunction with such functions as patchwork and sequential measurement of multiple positions. The stage moves automatically during observation and measurement, further reducing operation time.

Lineup of 3 models to suit your needs

Laser + Color Confocal

Specifications

Model / Specifications				Diverse application model: High-end model L7	Multi-function model: Standard model L3	Basic function model: Basic model C3
				Confocal scanning laser microscope / Full-color confocal microscope / Topography measurement by optical interferometry / Film thickness measurement by spectroscopic reflectometry	Confocal scanning laser microscope / Full-color confocal microscope	Full-color confocal microscope
Light source	Laser			405nm	405nm	–
	Xe / Hg-Xe			436nm,486nm,514nm,546nm, 578nm,633nm,White light	RGB	RGB
FOV/ Magnification		Objective lens	Magnification on the screen (24 inch)	Field of view (H×V)		
	White light	5×	92.5×	3,000×3,000µm		
		10×	185×	1,500×1,500µm		
		20×	370×	750×750µm		
		50×	925×	300×300µm		
		100×	1,850×	150×150µm		
	Laser	50×	1,850×	150×150µm		–
		100×	3,700×	75×75µm		–
Zoom function				1〜8×		
Frame memory	Brightness			1,024×1,024×12bit / High definition mode 2,048×2,048×12bit		
	Height			1,024×1,024×16bit / High definition mode 2,048×2,048×16bit		
Frame rate				15Hz〜120Hz		
Width measurement	Minimum unit of measurement			0.001µm		
	Accuracy			±【 0.02× (100/ magnification of objective lens) + L/1000 】µm		
	Measurement repeatability (3σ)※1			10nm		
Height measurement	Scale resolution			0.4nm		
	Accuracy			±(0.11+L/100) µm		
	Measurement repeatability (σ)※2			10nm		
	Measurement range※3			7mm		
Z stroke				80mm	100mm	
Nosepiece				5-hole motorized revolving nosepiece (with auto-recognition of lens position)		
XY stage	Manual			–	Yes	
	Motorized			Yes	Option	
Differential interference observation				Yes	Option	
Optical interference measurement				Yes	Option	
Spectroscopic reflectometer measurement				Yes	Option	
Atomic force microscope				Option		
Software	Image capture			Patchwork, HDR mode, search peak, first peak, multi-gain mode, etc.		
	Basic functions			Height measurement, line width measurement, surface roughness measurement (conforming to JIS and ISO standards), 3D display		
	Image processing			Filter, tilt correction, binarization, noise elimination, bit depth conversion, size conversion, color balance, etc.		
	Geometric property calculation			About 20 properties including area, volume, surface area, Feret diameter, center, roundness, maximum length, aspect ratio, etc.		
	Report generation			Layout, image database, template, batch conversion of filename extensions		
Utility				AC:100V 50/60Hz 600VA		
Dimensions and weight	Microscope unit			382(W)×511(D)×669(H)mm 41kg		
	Control unit			431(W)×450(D)×106(H)mm 7.1kg		
	Light source unit			142(W)×311(D)×227(H)mm 6.7kg		
	PC			175(W)×417(D)×360(H)mm 9.6kg		
Traceability				Yes		

※1 Repeatability of measurement of reference patterns using 150x (NA0.95) under no vibration condition
※2 Repeatability of measurement of VLSI Standards' step height standards using 100x (NA0.95) under no vibration condition
※3 Up to the maximum distance of movement for the objective lens