OLYMPUS®

Your Vision, Our Future

3D Measuring Laser Microscope

OLS4100

LEXT

Bringing Answers to the Surface

Precise measurement. Faster operation. High-quality imaging.

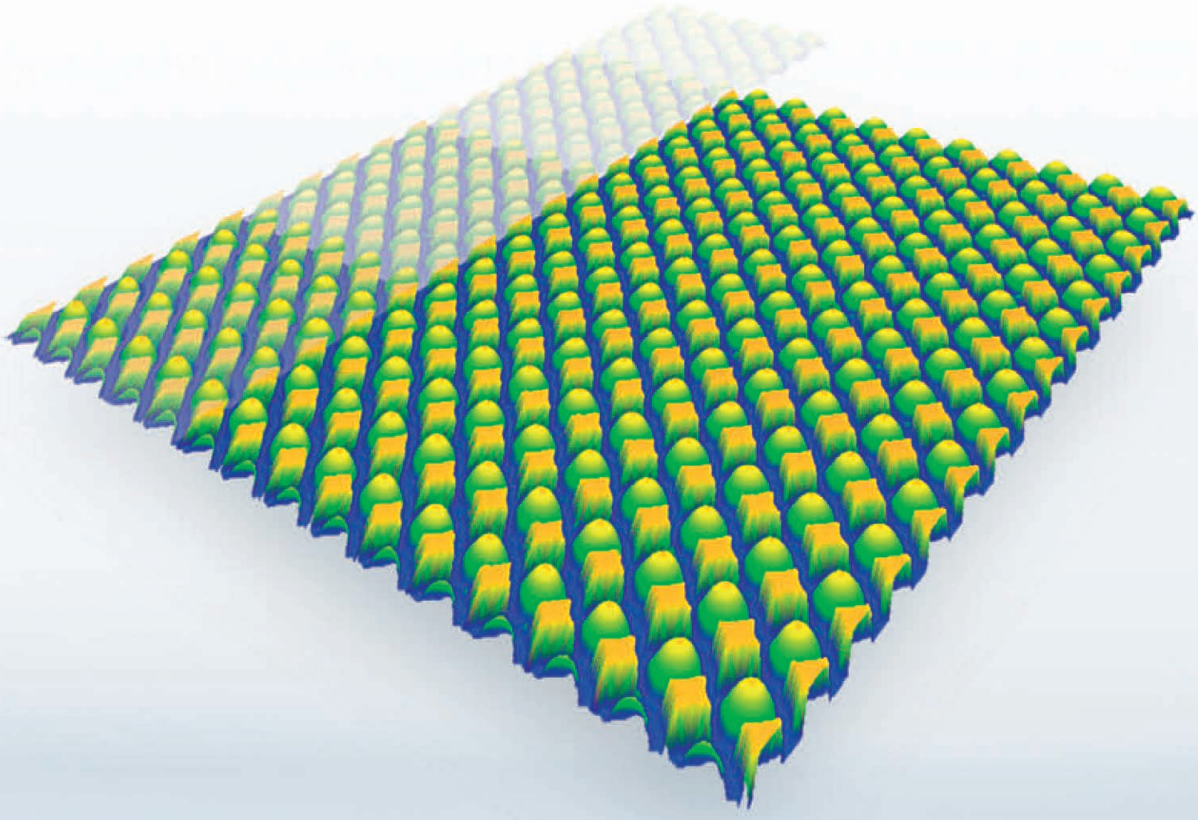
Expanding the Boundaries of Laser Microscopy

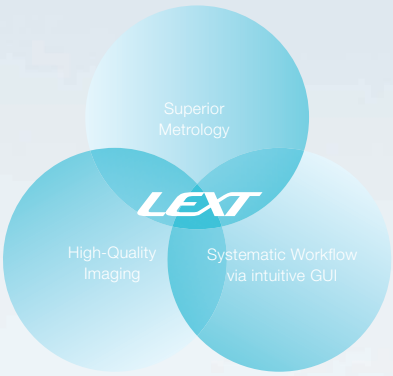
Measurements and images you can count on. Every time.

LEXT OLS4100

Widely used in quality control, research, and development across an array of industries and applications, OLYMPUS LEXT 3D measuring laser microscopes have set new standards in 3D laser microscopy. Now, as demand grows for increased measurement precision and wider observation applicability, Olympus has responded with the new LEXT OLS4100. Designed to facilitate faster, easier measurement and higher-quality imaging, the OLS4100 is expanding the boundaries of laser microscopy.

The new OLYMPUS LEXT OLS4100. Going beyond the borders of possibility.





Contents

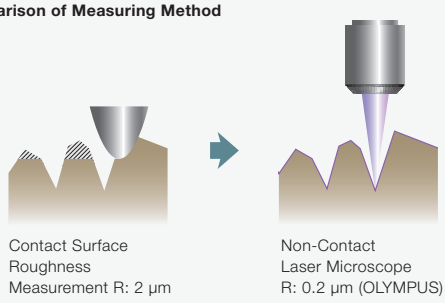
Advantages of Laser Scanning Microscopes

Fast Non-Contact, Non-Destructive Imaging and Measurement

Non-Contact, Non-Destructive Measurement

Unlike stylus-based contact-type surface roughness gauges, laser scanning microscopes (LSMs) employ a low-power light that will prevent damaging the surface.

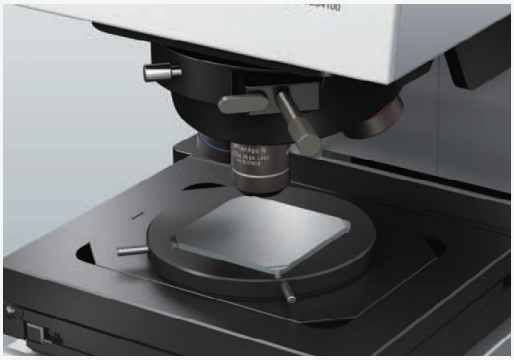
• Comparison of Measuring Method



Imaging Without Sample Preparation

A scanning electron microscope (SEM) requires extensive sample preparation such as vacuum evaporation and/or altering the sample to fit in the observation chamber. An LSM allows the measurement of samples without any prior preparation, and immediate imaging after placing the sample on the stage.

• Start Imaging Without Sample Preparation



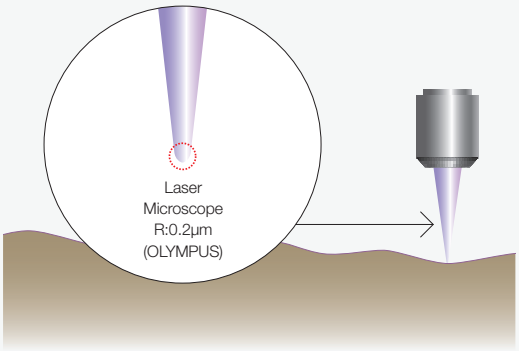
LSM Solution for		
SEM Samples	Roughness Gauge Samples	With an LSM, the sample can be safely returned to the production line or experiment thanks to non-destructive measurement.

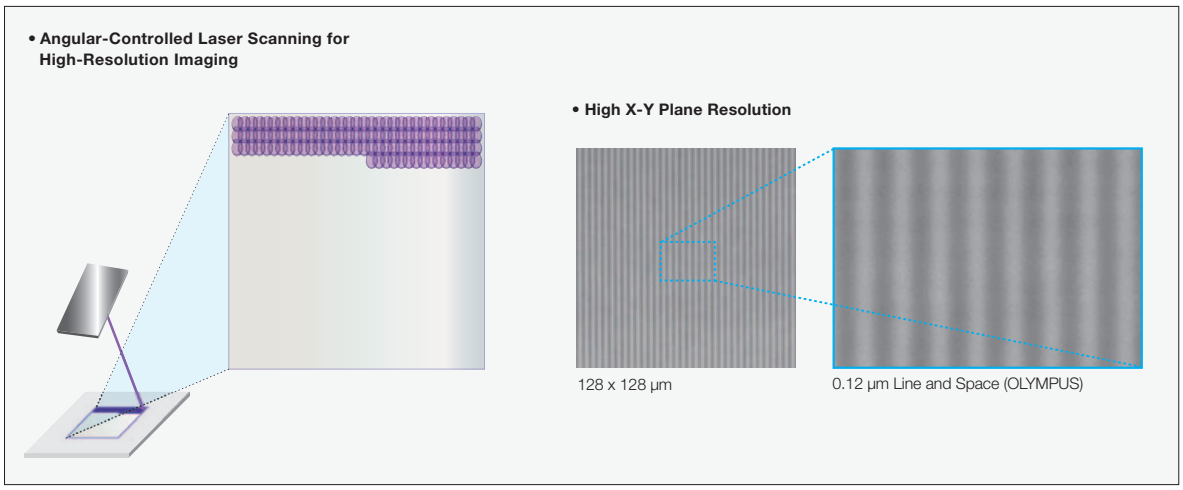
Superior X-Y-Axis Measurement

Accurate Measurement of Submicron Distances Across the X-Y Axes

An interferometer is based on a normal white-light optical microscope, and so achieves the same lateral resolution. With a larger-aperture objective and reduced wavelength, the resolution of an LSM is greatly improved over typical white light microscopes. In addition, precise angular-controlled movement of the laser focus means that an LSM can perform accurate X-Y plane sub-micron measurements on diverse types of samples.
The OLS4100 achieves a lateral resolution of 0.12 microns.

• Micron-Order Laser Spot

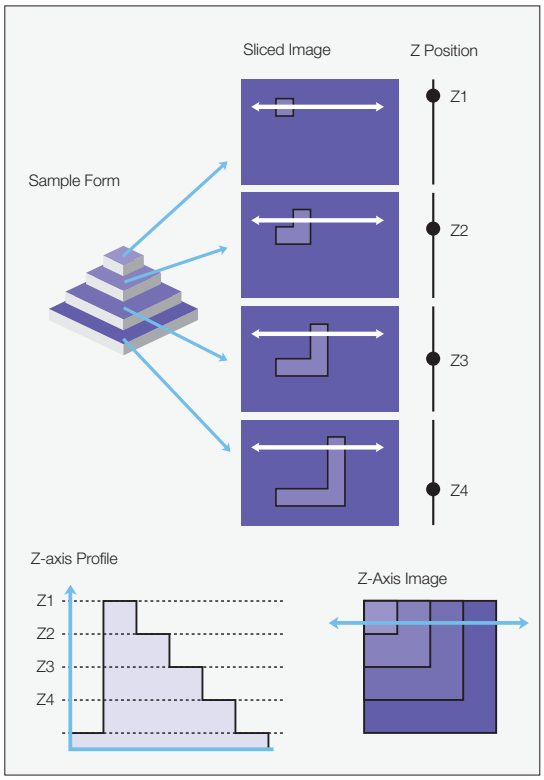




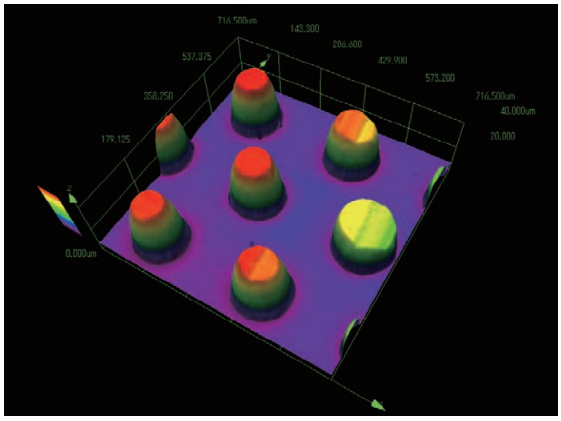
LSM Solution for	
Interferometer Samples	LSMs have superior horizontal resolution due to a confocal optical system, making it easy to measure the surface of the specific region of interest.

Superior Z-Axis Measurement

Accurate Measurement of Submicron Heights Across the Z-Axis



An SEM delivers excellent high-resolution images but lacks any height information. With a short-wavelength laser and its confocal optical system, an LSM only detects in-focus reflections from a single specified focal plane along the Z-axis. Combined with a high-precision linear scale, this allows high-definition imaging and accurate 3D measurement.
The OLS4100 can achieve a Z-axis resolution of 10 nanometers.



LSM Solution for		
SEM Samples	Interferometer Samples	LSMs are ideal for measuring the surface contour of samples with undulations ranging from several hundred micro-meters to the submicron order.

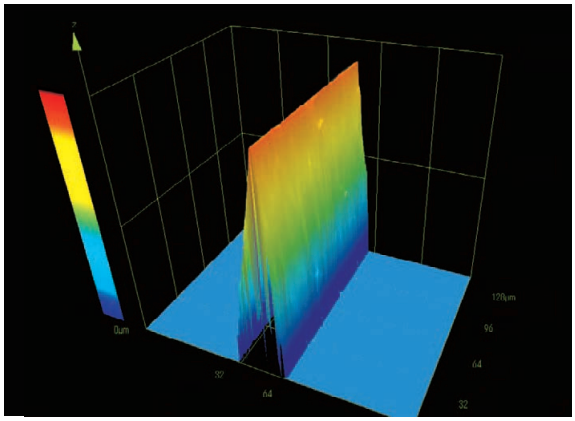
Superior Metrology

3D measurement of diverse samples with 10 nm height resolution and advanced measurement parameters.

Wider Sample Range

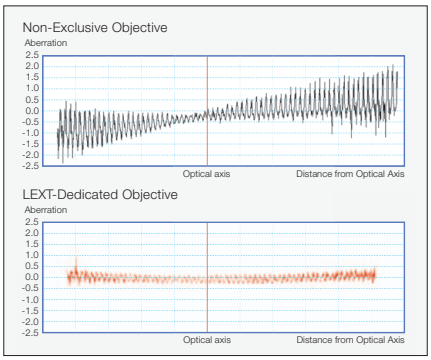
Imaging Slopes up to 85°

Thanks to dedicated objectives with high numerical apertures and a dedicated optical system that obtains superior performance from a 405 nm laser, the LEXT OLS4100 can reliably measure acute-angled samples that were previously impossible to measure. These capabilities also enable measurement of micro-roughness on an uneven surface.



Razor with an Acute Angle

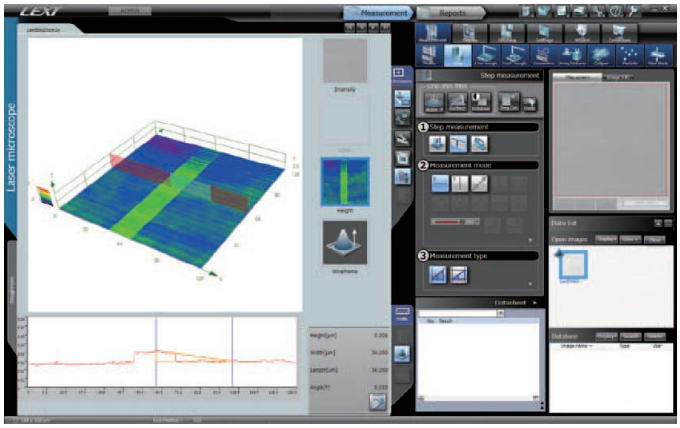
LEXT-Dedicated Objectives



Minimized Aberrations with Dedicated Objective

Micro-Profile Measurements with 10 nm Height Resolution

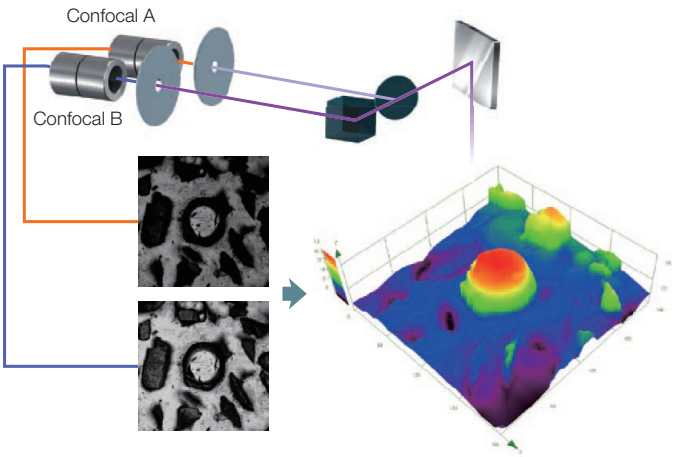
With the OLS4100, an impressive X-Y resolution of 0.12 microns is now possible thanks to a short-wavelength 405 nm laser and a high-aperture objective. As a result, the OLS4100 can perform submicron measurements of a sample's surface. With a precise 0.8 nanometer-resolution linear scale and software algorithms such as our original I-Z curve (see page 23), the OLS4100 can resolve height differences of 10 nanometers.



(MPLAPON50XLEXT)
STEP Height standard Type B, PTB-5, Institut für Mikroelektronik, Germany,
6 nm Detection in Height Measurement

Overcoming Reflectance Differences

The OLS4100 employs a dual confocal system, incorporating two confocal optical light paths. In combination with a high-sensitivity detector, this enables the OLS4100 to capture a precise 3D image from a sample consisting of materials with different reflectance characteristics.

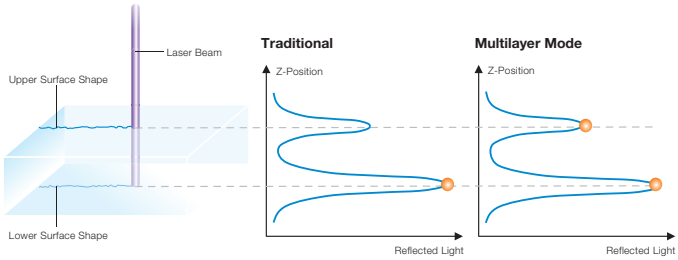


Diamond Electroplated Tool
Objective : MPLAPON50XLEXT

Applicable to Transparent Layers

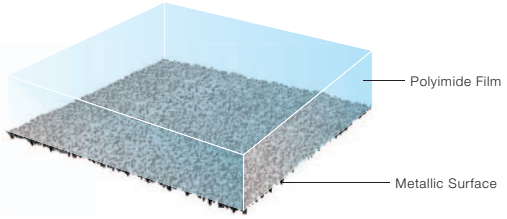
Multilayer Mode

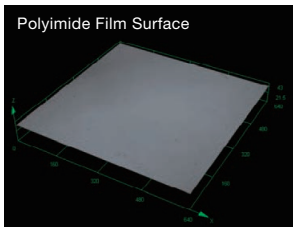
The LEXT OLS4100's new multilayer mode is capable of recognizing the peaks of reflected light intensities originating from multiple layers. Setting each layer as the focal point makes it possible to observe and measure the upper surface of a transparent sample. This also enables the analysis of multiple layers, measuring the thickness of each layer.

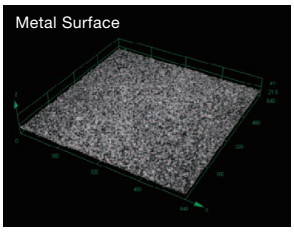


Observation/Measurement of Multiple Layers of Transparent Material

The multilayer mode facilitates observation and measurement of the transparent layer on the surface of a transparent sample. Even with a transparent resin layer on a glass substrate, the shape and roughness of each layer, as well as the thickness of the surface film, can be measured.



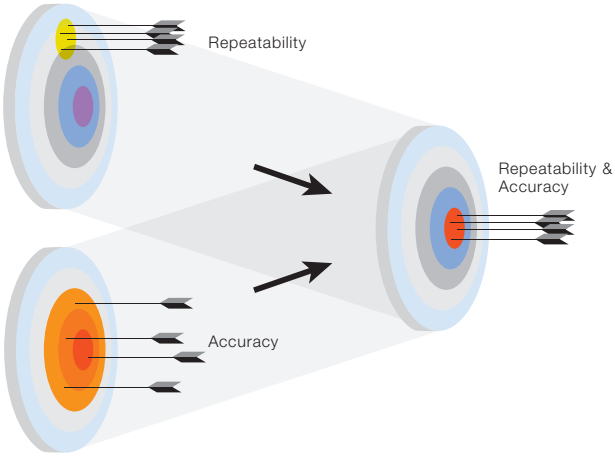




Industry's First* Double Performance Guarantee

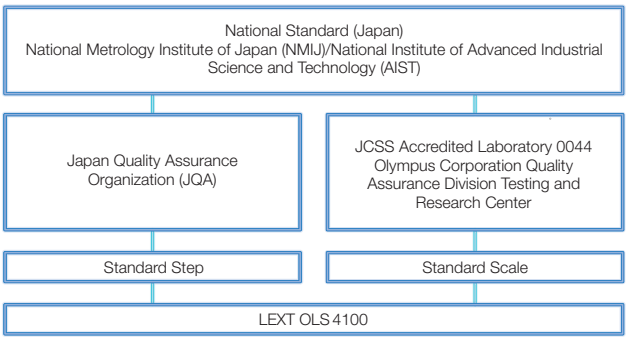
Accuracy and Repeatability

The performance of a measuring tool is typically expressed using two different terms: “accuracy,” which indicates how close a measurement value is to its true value, and “repeatability,” which indicates the degree of variations among repeated measurement values. The OLS4100 is the industry's first* LSM able to assure both accuracy and repeatability.



Traceability System

The OLS4100 uses a rigorous system of production for every component. From the objective to the laser head, Olympus delivers only the highest-quality systems based on comprehensive inspection to the strictest standards. On delivery, final adjustment and calibration is performed by qualified engineers in the actual measurement environment.



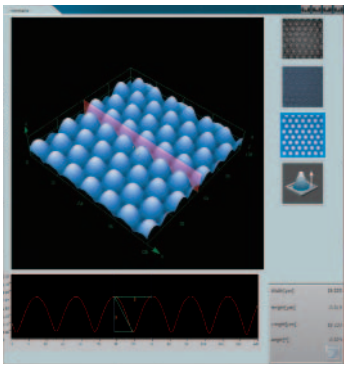
*According to Olympus survey as of Dec 2008.

Wide Range of Measurement Types

Seven Measurement Modes

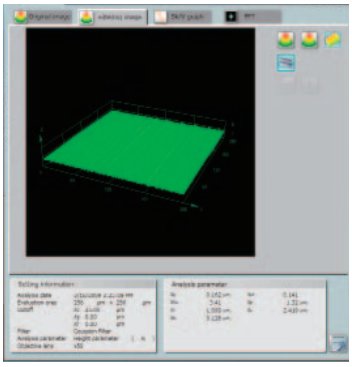
Step Measurement

This mode allows measurement of a step between any two arbitrary points on a surface profile. Profile Measurement is also available.



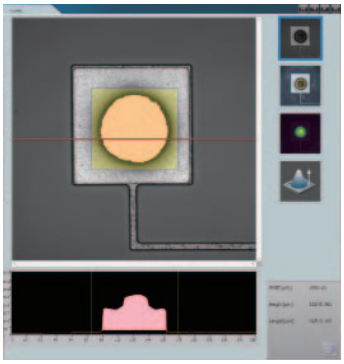
Surface Roughness Measurement

This mode allows measurement of line roughness on one line and plane roughness on the entire surface.



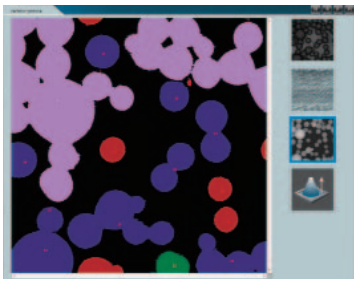
Area/Volume Measurement

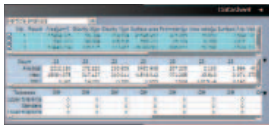
With a user-defined threshold level on a surface profile, this mode allows measurement of the volume (or area) of a geometry above or below the threshold level.



Particle Measurement*

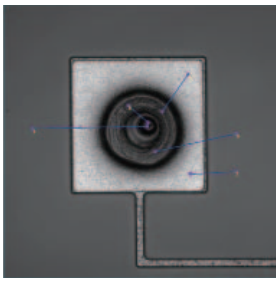
This mode enables auto-separation of particles with the separator function, setting of a threshold level, and setting of a detection range within a region of interest.





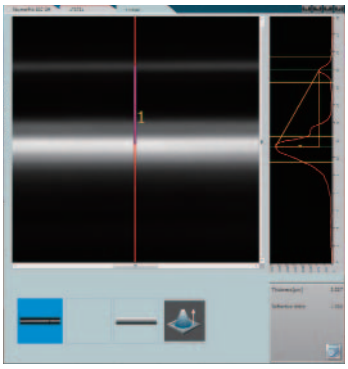
Geometric Measurement

This mode allows measurement of the distance between two arbitrary points on a geometric image. The geometric shape and angle for circle, rectangle, etc. are measured.



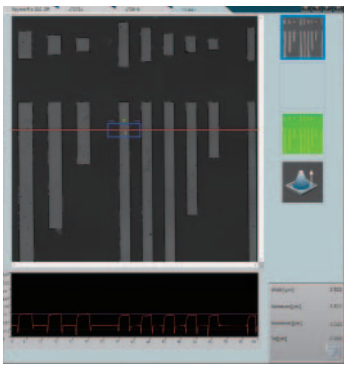
Film Thickness Measurement*

This mode allows the thickness of a film on a transparent body to be measured by detecting changes in refractive index.



Auto Edge Detection/ Measurement*

This mode allows a line width or a diameter to be measured by automatically detecting edges in a geometric image. This reduces uncertainty by eliminating operator error.



OLYMPUS Stream*

Workflow Solution for Improved Image Analysis Performance

For grain size analysis or nonmetallic inclusion rating, optional OLYMPUS Stream micro-imaging software is available, which can be uploaded directly from the OLS4100.

"OLYMPUS Stream" Launch Button

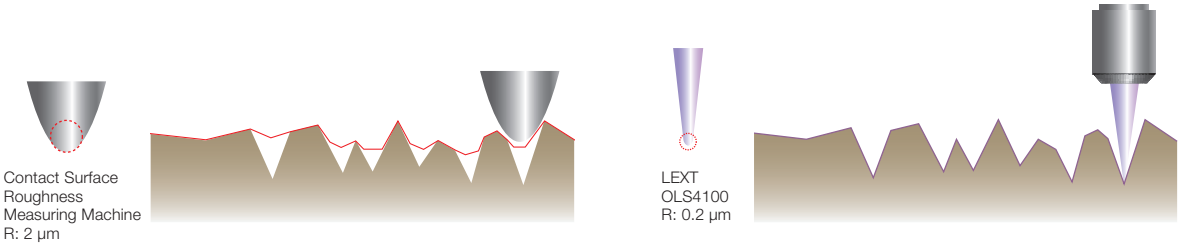
*Optional unit.

Improved Roughness Measurement

The LEXT OLS4100 has been developed to represent a new standard of surface roughness measuring. The OLS4100 is calibrated in the same way as contact surface roughness gauges and has the necessary roughness parameters and filters required per ISO and JQA. This allows users with contact surface roughness gauges to obtain output results from the system consistent with their existing instruments, with the advantage of greater speed and non-contact measurement. The OLS4100 has a roughness-specific mode enabling roughness profile measurement for sample lengths up to 100mm with an automatic line stitching function.

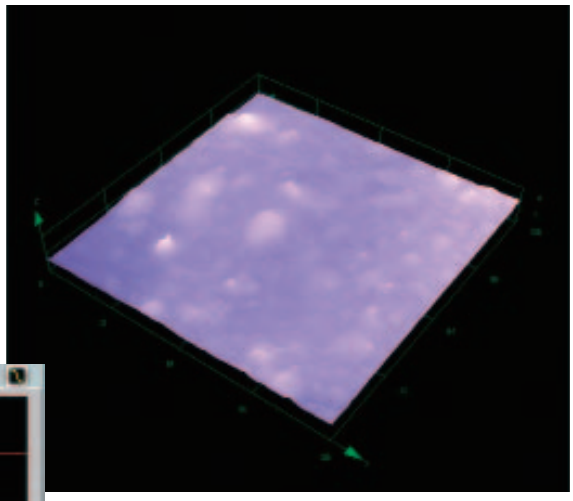
Micro Roughness

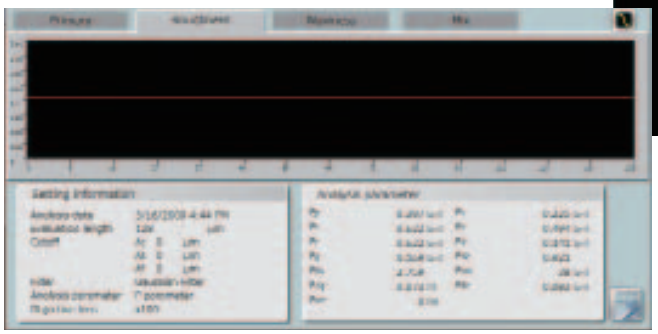
Contact surface roughness gauges cannot measure micro surface contours less than the stylus tip diameter. The OLS4100 can measure the surface roughness of micro geometries at high resolution due to a minute laser spot diameter.



Non-Contact Measurement

Since a contact surface roughness gauge uses a hard needle-shaped stylus, it is more likely to scratch the surface of a soft specimen, damaging or deforming it. With adhesive specimens, on the other hand, the stylus can attach to the specimen and be damaged when pulled loose, making it impossible to obtain correct results. The OLS4100, a non-contact laser microscope, can perform accurate surface roughness measurement regardless of surface texture conditions.





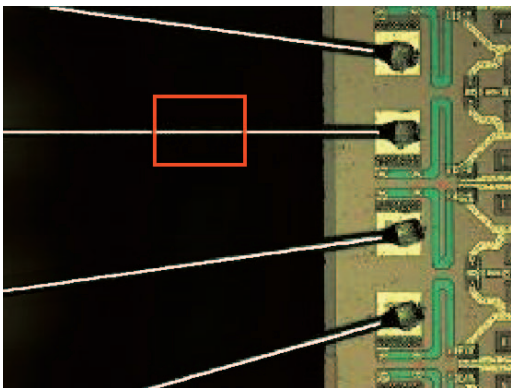
Polymer Film 3D image (above) and Results of Roughness Measurement (left)

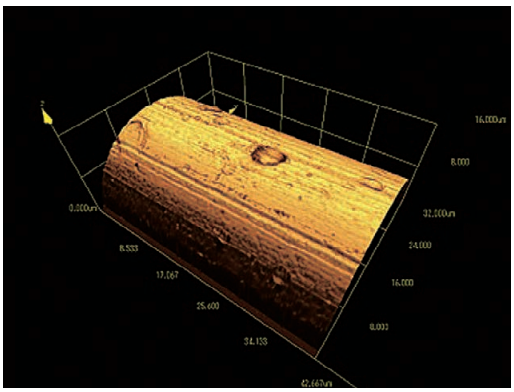
Soft Specimen

Adhesive Specimen

Measurement of Features at the Micron Level

Surface roughness gauges cannot measure micron-level features since their styli are not able to access these areas. The OLS4100 can correctly identify a measuring position and easily perform roughness measurement of a target micro area.





Bonding Wires

LEXT OLS4100 Parameters

Parameter Compatibility

The OLS4100 comes with the same Surface Profile Parameters as contact-type surface roughness gauges, offering compatible operability and measurement results.

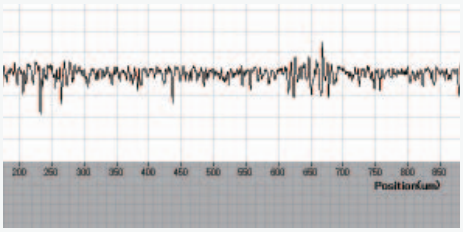
Primary Profile	*: Pp, Pv, Pz, Pc, Pt, Pa, Pq, Psk, Pku, Psm, PΔq, Pmr(c), Pδc, Pmr*
Roughness Profile	*: Rp, Rv, Rz, Rc, Rt, Ra, Rq, Rsk, Rku, Rsm, RΔq, Rmr(c),Rδc, Rmr, RZJIS, Ra75*
Waviness Profile	*: Wp, Wv, Wz, Wc, Wt, Wa, Wq, Wsk, Wku, Wsm, WΔq, Wmr(c), Wδc, Wmr*
Bearing Area Curve	*: Rk, Rpk, Rvk, Mr1, Mr2*
Motif	*: R, Rx, AR, W, Wx, AW, Wte*
Roughness Profile (JIS1994)	*: Ra(JIS1994), Ry, Rz(JIS1994), Sm, S, tp*
Others	*: R3z, P3z, PeakCount*

Accommodating Next-Generation Parameters

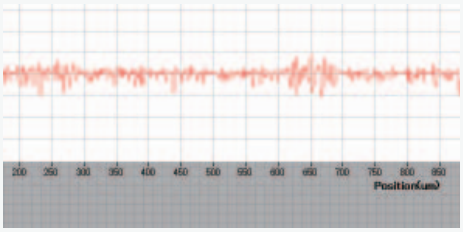
The OLS4100 comes with roughness (3D) parameters conforming to ISO25178 for reliable evaluation of the planar area.

Amplitude Parameters	*: Sq, Ssk, Sku, Sp, Sv, Sz, Sa*
Functional Parameters	*: Smr(c), Sdc(mr), Sk, Spk, Svk, SMr1, SMr2, Sxp*
Volumetric Parameters	*: Vv(p), Vvv, Vvc, Vm(p), Vmp, Vmc*
Lateral Parameters	*: Sal, Str*

- **LEXT OLS4100 performance is comparable with results of a surface roughness gauge.**



Primary Profile from LEXT OLS4100
λs=2.5 μm with Filtering



Primary Profile from a Contact Surface Roughness Gauge

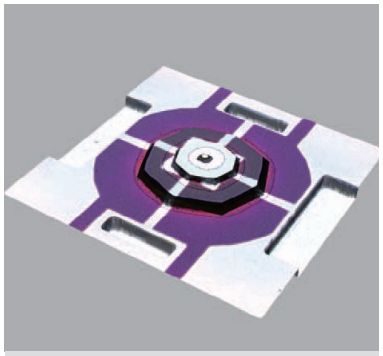
High-Quality Imaging

For clear 3D color images, high-sensitivity laser DIC, or high-dynamic range (HDR) images.

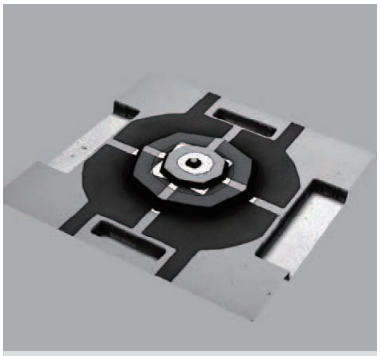
Crystal-Clear 3D Color Images

Three Types of Integrated Images

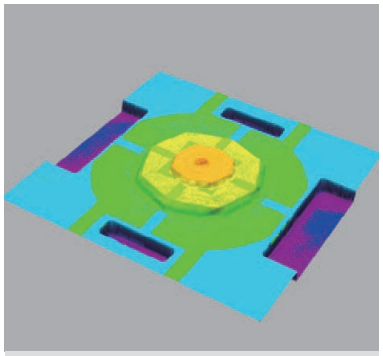
The LEXT OLS4100 can acquire three different types of information at the same time: a true-color optical microscope image, a laser microscope image, and height map. The OLS4100 makes it possible to capture an optical microscope image consisting of in-focus pixels only, and integrate them with a true-color optical microscope image containing height information.



Real-Color 3D Image



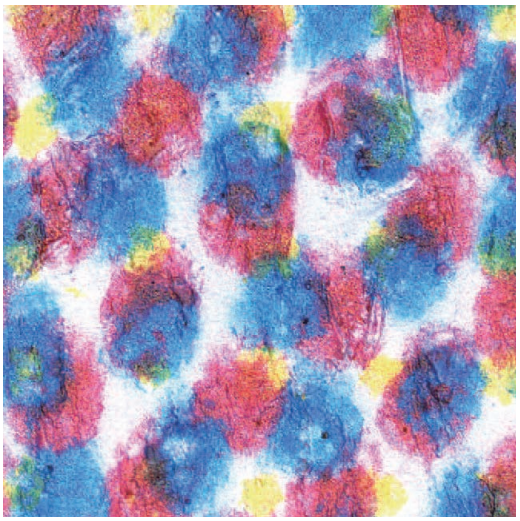
Confocal 3D Laser Image



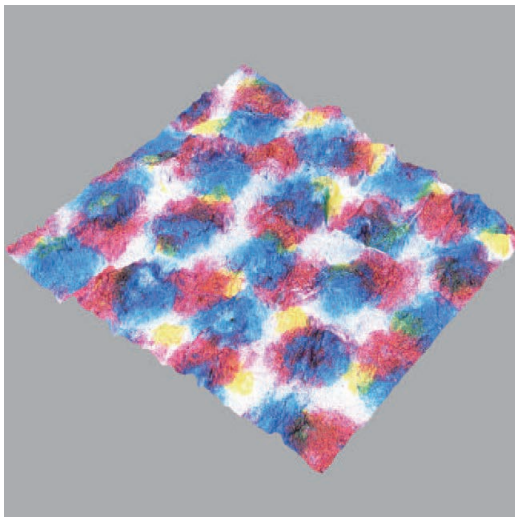
Height Map

Natural Color Reproduction

The OLS4100 uses a white LED light and a high-color-fidelity CCD camera to generate clear, natural-looking color images, comparable to those obtained with high-grade optical microscopes.



2D Color Image (Inkjet Dots on Paper, Objective 20x)



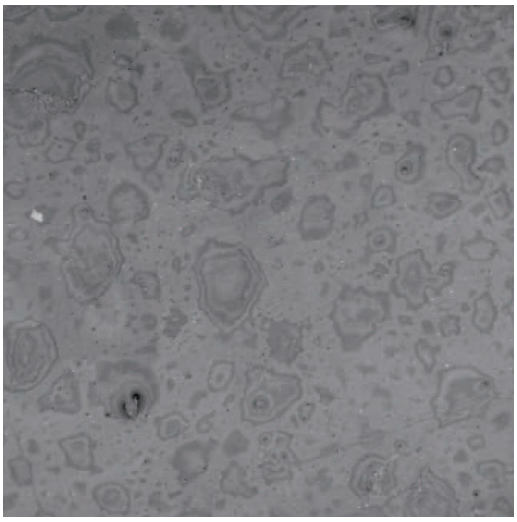
3D Color Image (Inkjet Dots on Paper, Objective 20x)

More Realistic Surface Reproduction

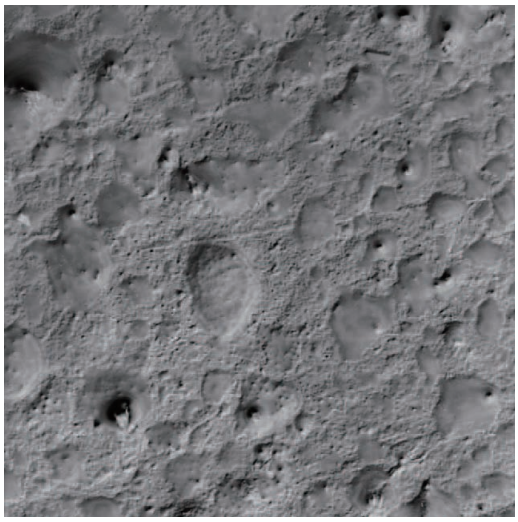
Laser DIC (Differential Interference Contrast)

DIC

Differential Interference Contrast (DIC) is an observation method used to visualize nanometer micro surface contours, which normally lie far beyond the resolving power of a laser microscope. Thanks to its DIC laser mode, the LEXT OLS4100 allows you to obtain live images comparable to those of an electron microscope, under relatively low power magnifications.

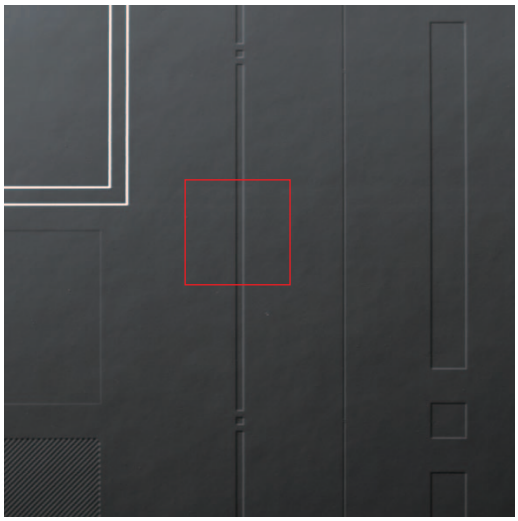


Laser Image without DIC (Polymer Film)



Laser Image with DIC (Polymer Film)

Laser Image without DIC (5x Objective)
STEP Height standard Type B, PTB-5, Institut für Mikroelektronik, Germany



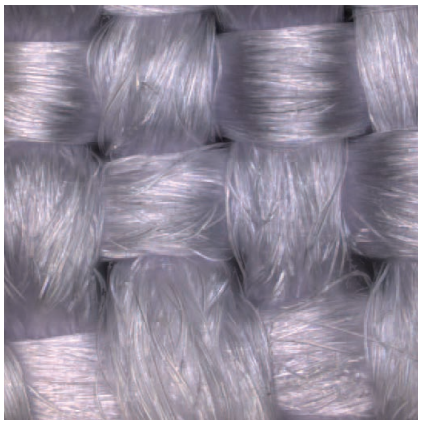
Laser Image with DIC (5x Objective)
STEP Height standard Type B, PTB-5, Institut für Mikroelektronik, Germany,
Actual Height of the Feature : 6 nm

Optimized Balance Between Brightness and Contrast

HDR (High Dynamic Range) Imaging

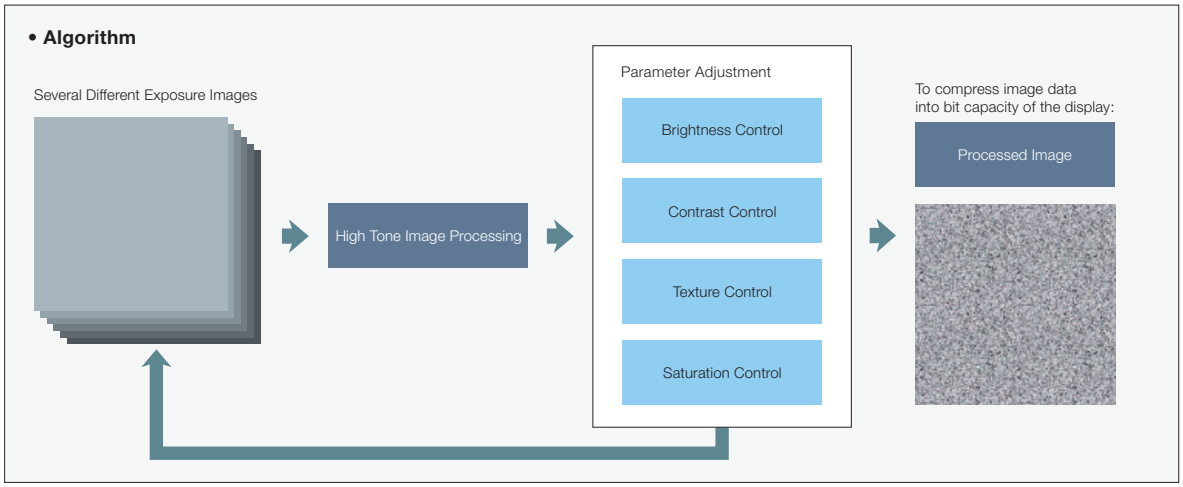
HDR

The OLS4100's High Dynamic Range (HDR) function combines several optical microscope images captured using different exposures. Brightness, contrast, texture, and saturation are controlled individually so that HDR creates images with a wide dynamic range. This enables clear visualization of a color image, especially for samples lacking texture.



Color Image without HDR
(Super-Density Fabric, Objective 20x, Zoom 1x)

Color Image with HDR
(Super-Density Fabric, Objective 20x, Zoom 1x)



Stabilization of Measurement and Imaging Environments

To eliminate external influences on measurement and imaging, the OLS4100 incorporates a hybrid vibration-dampening mechanism using coil springs and dampening rubber to stabilize the operating environment. This eliminates the need for a dedicated vibration-dampening stand, allowing measurements on any desktop.

Hybrid Vibration-Dampening Mechanism