

OPTICAL MICROSCOPE



SEM



ROUGHNESS GAUGE



3D SURFACE PROFILER







Combine the capabilities of an OPTICAL MICROSCOPE, SEM, and ROUGHNESS GAUGE



NEW
3D Surface Profiler
VK-X Series

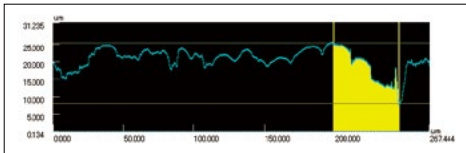
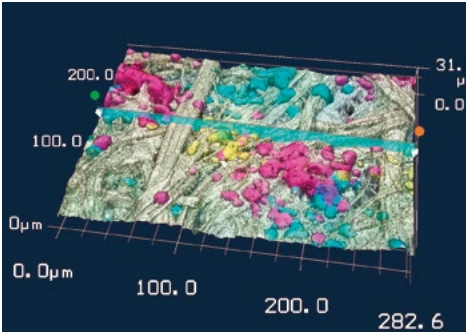
Total SOLUTION! With high-resolution color imaging and nanometer-level profile measurement functions, KEYENCE's 3D Surface Profiler overcomes the inadequacies of conventional imaging and profiling technologies.

Compare the VK-X Series to other technologies

	 Optical microscope	 SEM	 Roughness gauge	 3D Surface Profiler VK-X Series
No preprocessing	✓		✓	✓
High definition ultra-depth examination		✓		✓
Color examination	✓			✓
3D measurement			Possible	✓

* Comparison with commonly used optical microscope, SEM and roughness gauge.

LASER + COLOR IMAGE
Accurate reproduction of target color and shape





OPTICAL MICROSCOPE



3D SURFACE PROFILER

COMMON PROBLEMS

SOLUTION

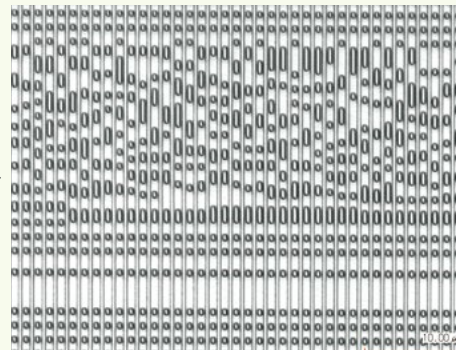
CASE1

Low resolution, weak contrast



Disc pits (6000x)

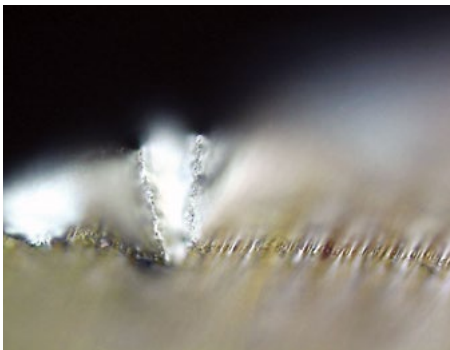
High resolution, 28800x magnification



Disc pits (6000x)

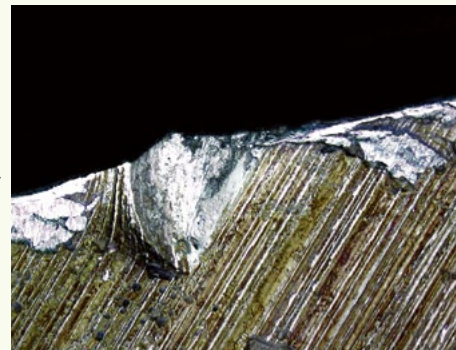
CASE2

Shallow depth of field



Blade edge (1000x)

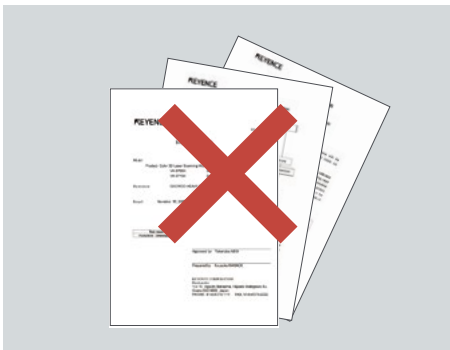
Fully-focused image



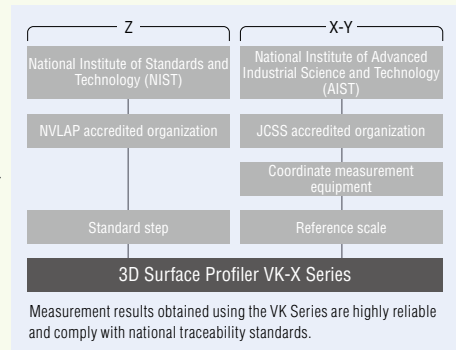
Blade edge (1000x)

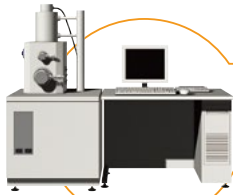
CASE3

No support for traceability



Traceability compatible





SEM



3D SURFACE PROFILER

COMMON PROBLEMS

SOLUTION

Monochrome image only



Sandpaper (400x)

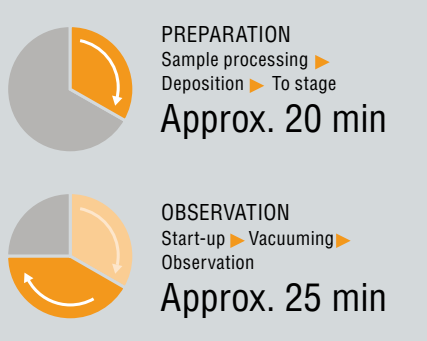
HD Real Color



Sandpaper (400x)

CASE1

Time-consuming preparation and observation

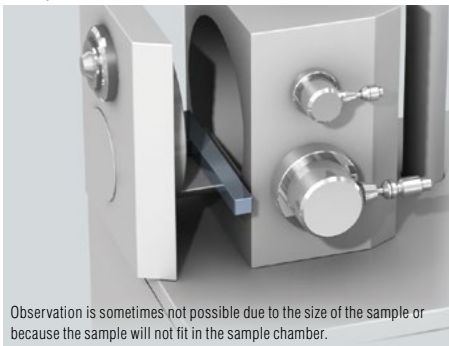


No need for sample prep

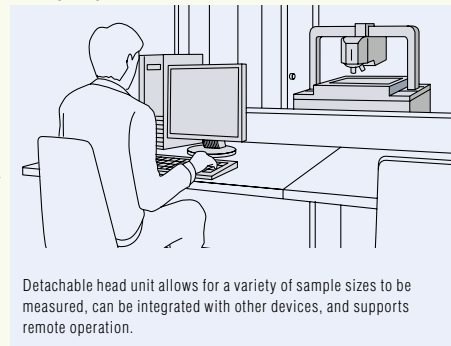


CASE2

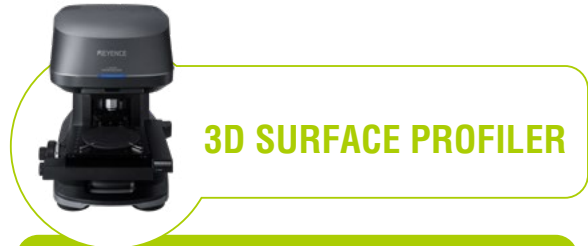
Sample size is restricted



Measure samples of any size and nearly any material



CASE3

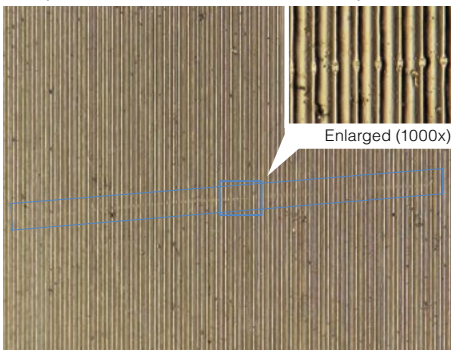


COMMON PROBLEMS

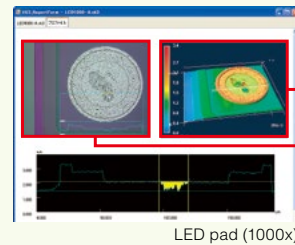
SOLUTION

CASE1

Sample scratched due to contact with probe

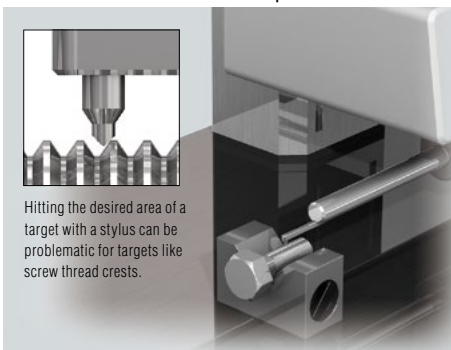


Non-contact design can be used for soft targets

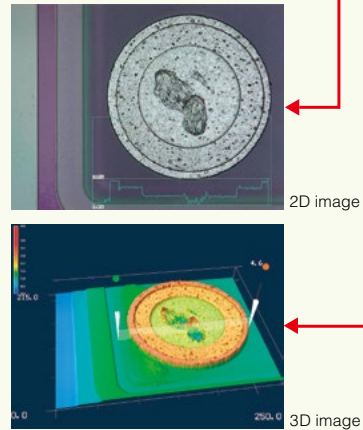


CASE2

Difficult to measure desired spots

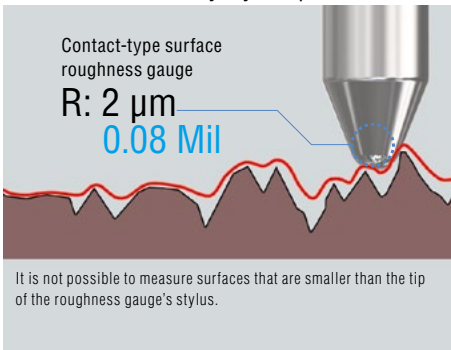


Check screen to measure target area

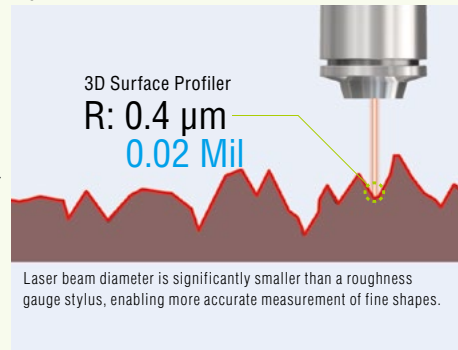


CASE3

Resolution is limited by stylus tip diameter



Laser beam diameter is smaller than stylus diameter



3D SURFACE PROFILER FEATURES

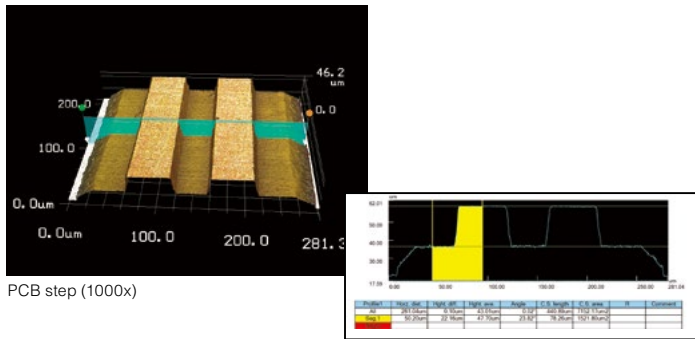
Robust set of measurement tools for 2D and 3D analysis

PROFILE MEASUREMENT

- Height measurement
- Width measurement
- Cross-section measurement
- 2D/3D angle measurement
- Radius-of-curvature measurement

The VK-Analyzer software can measure the height, width, cross-section, angle, or radius-of-curvature of any user-specified line or curved cross-section profile.

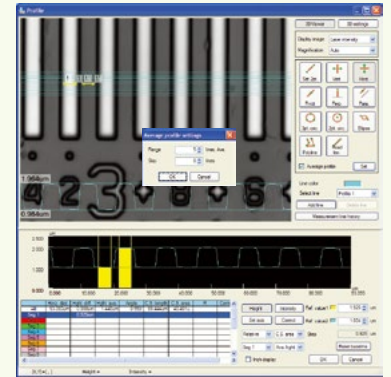
Height, Width, and Cross-section measurement



PCB step (1000x)

Average Profile function

When measuring shape and roughness, the VK-Analyzer lets you set parameters such as measurement line thickness. You can take measurements using average shapes, eliminating measurement location-specific variations from the analysis.

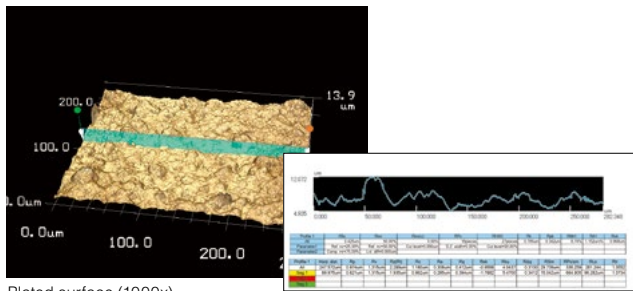


ROUGHNESS MEASUREMENT

- Line roughness
- Surface roughness

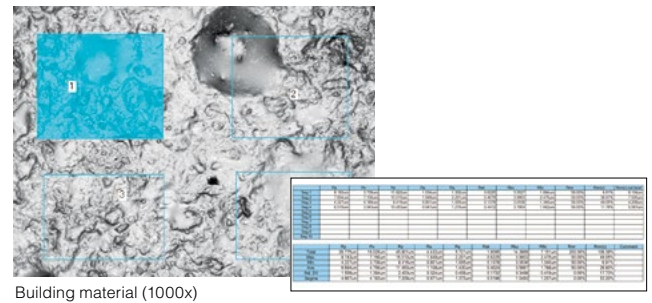
The VK-Analyzer software enables non-contact measurement of line roughness of any straight or curved line specified in the image, and surface roughness of any user-specified area. Non-contact roughness measurements offer several benefits when compared to conventional contact gauges, such as more accurate measurements and scratch-free samples.

Line roughness measurement



Plated surface (1000x)

Surface roughness measurement



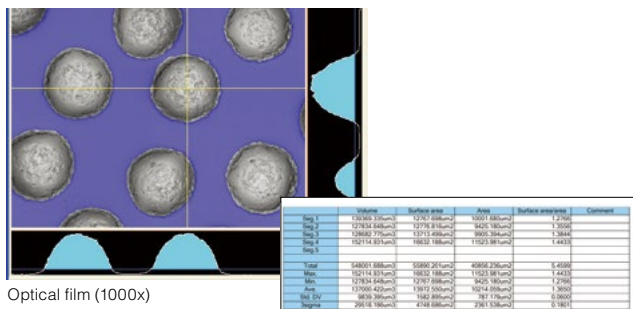
Building material (1000x)

3D MEASUREMENT

- Volume
- Surface area
- Surface area to area ratio

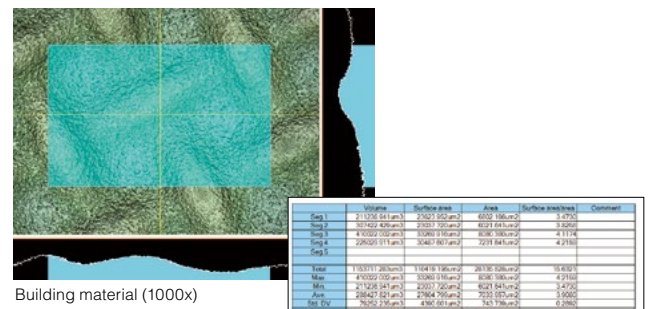
Measures volume, surface area, and surface area to area ratio of objects in any specified area on the screen.

Volume measurement



Optical film (1000x)

Surface area measurement



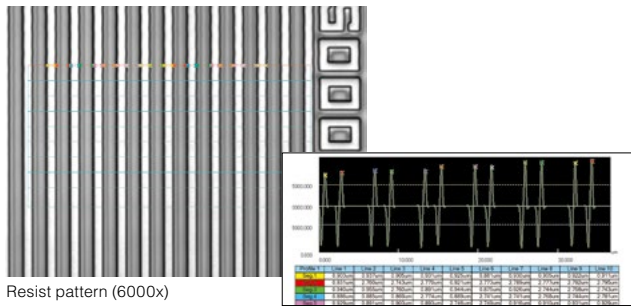
Building material (1000x)

AUTOMATIC MEASUREMENT

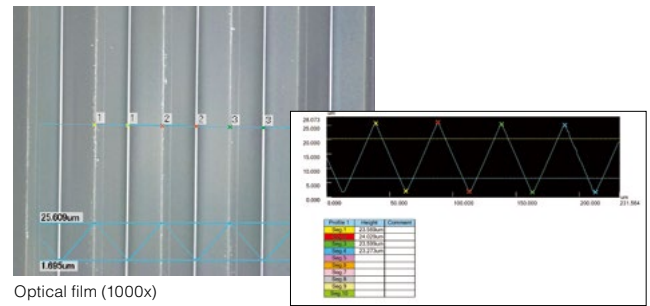
- Width measurement
- Height measurement

Set conditions for executing automatic height and width measurements of targets with repeating patterns such as semiconductors, displays, and optical components. This allows for rapid measurement of multiple samples and eliminates all areas of user-subjectivity.

Automatic width measurement



Automatic height measurement



COMPARATIVE MEASUREMENT

- Compare two target objects and measure their differences

Display overlapping cross-section profiles of two target objects and measure their differences in width, height, and profile. This feature enables comparative evaluations of target objects before and after testing, their changes over time, or due to different manufacturing conditions.

Profile comparative measurement

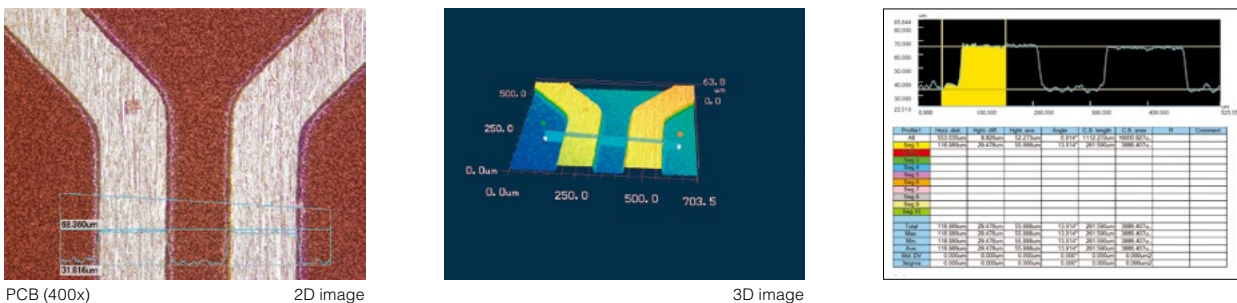


2D & 3D MEASUREMENT

- Set measurement locations in 2D and 3D images

Measurements made on a 2D image can be simultaneously displayed on the 3D image and profile. This provides the user with multiple perspectives and speeds up the analysis process.

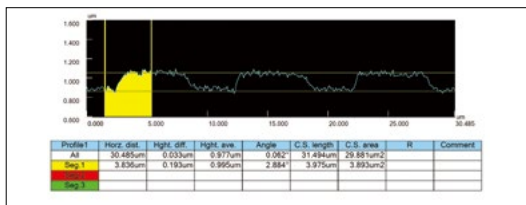
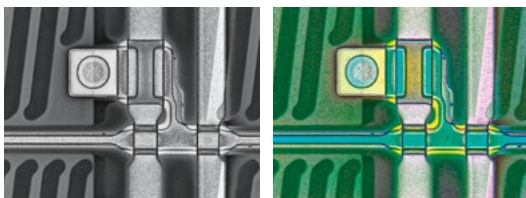
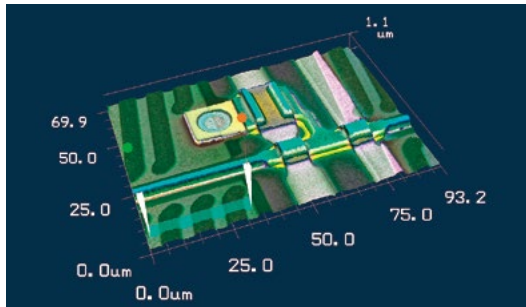
2D + 3D measurement



3D SURFACE PROFILER APPLICATIONS

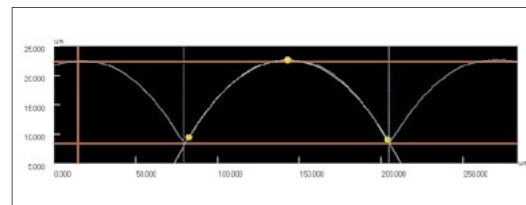
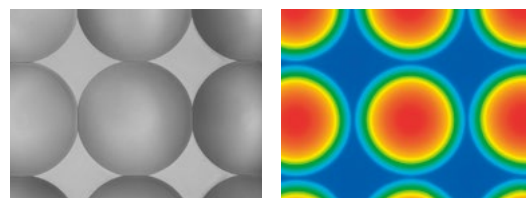
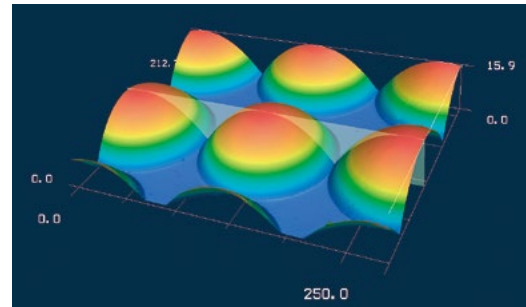
Analysis examples by industry

ELECTRONICS



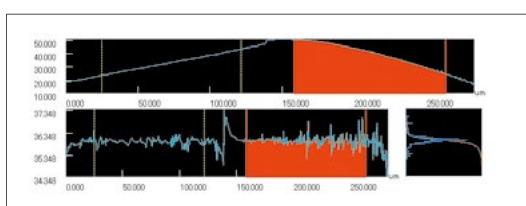
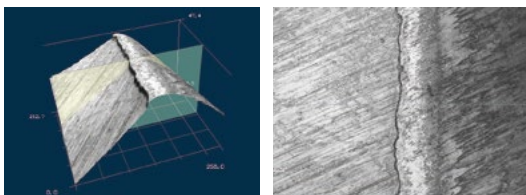
TFT height measurement (1000x)

OPTICAL COMPONENTS



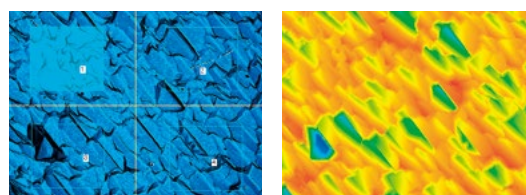
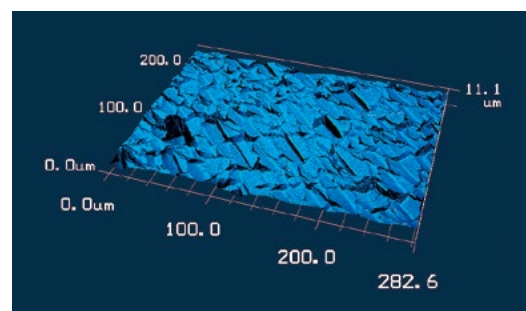
Microlens, R measurement (1000x)

METAL/TRANSPORTATION



Tool's cutting edge profile, roughness gauge (1000x)

BATTERY



	Volume	Surface area	Area	Surface area/ar...	Comment
Seg. 1	23757.822um ³	10642.131um ²	9948.814um ²	1.0697	
Seg. 2	67357.039um ³	10532.509um ²	9735.521um ²	1.0819	
Seg. 3	66765.873um ³	11251.915um ²	9899.452um ²	1.1366	
Seg. 4	66674.796um ³	9849.145um ²	9131.979um ²	1.0785	
Seg. 5					
Total	274555.530um ³	42275.699um ²	38715.766um ²	4.3667	
Max.	73757.822um ³	11251.915um ²	9948.814um ²	1.1366	
Min.	66674.796um ³	9849.145um ²	9131.979um ²	1.0697	
Ave.	69538.883um ³	10568.925um ²	9678.942um ²	1.0917	
Std. Dev.	2967.005um ³	497.806um ²	325.509um ²	0.0263	
Sigma	8901.014um ³	1493.418um ²	976.528um ²	0.0790	

Surface area measurement of a solar battery (1000x)

Explanation of the measurement principle

The 3D surface profiler employs two light sources: a short-wavelength laser source and a white light source. These two types of light sources enable acquisition of both laser intensity and color images, enabling the capture of fully-focused and height/color map images.

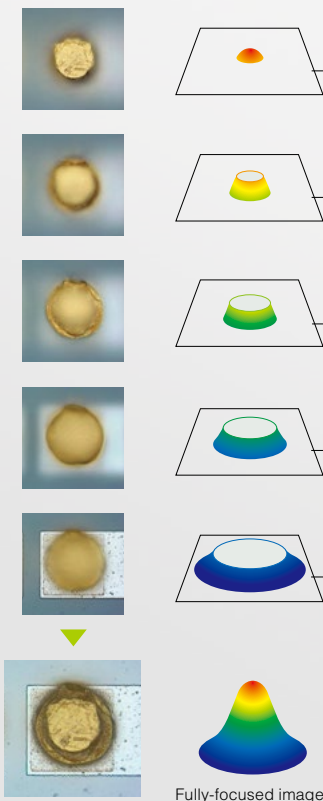
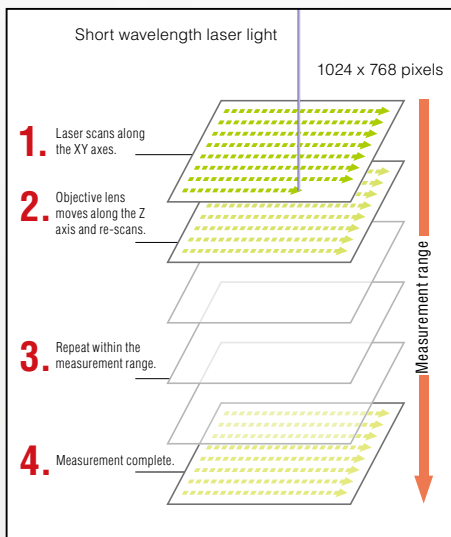
High-resolution height information obtained by 408 nm scanning laser

In order to construct a fully-focused image with height-data associated with each pixel, the laser must first scan across a sample in X and Y directions. After completing the scan, the objective lens is driven in the Z-direction and the scanning process repeats. Once this is done for the entire measurement range of the sample, a fully-focused laser image and height/color map is displayed.

Acquire color information with a CMOS camera

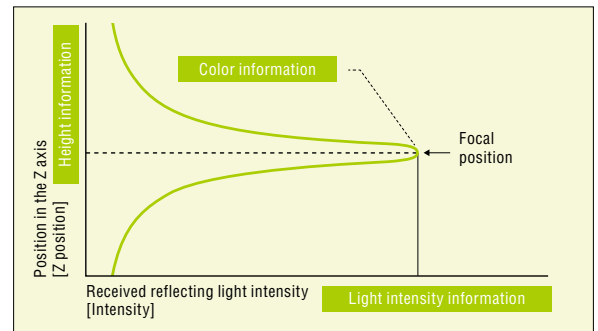
Additionally, by using a color CMOS camera, reflected light from the white light source produces a focused color image. This is then coupled with the laser intensity image to provide a true color, fully-focused image - impossible to capture with a conventional optical microscope or SEM.

Diagram of the measurement principle

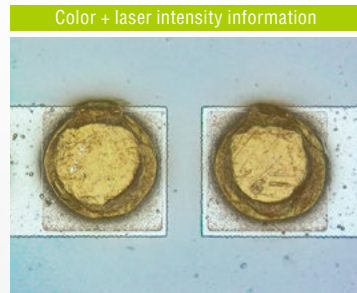


Explanation of the acquired data

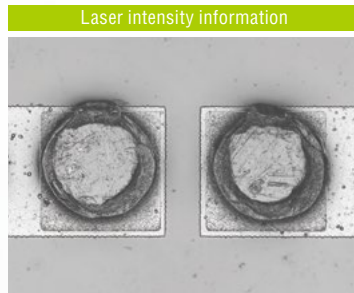
Each pixel on a single plane surface (1024 x 768 pixel) acquires reflecting light intensity information (Intensity) based on the Z axis position (Z-position) as indicated in the figure on the right. The Z axis position with the highest reflecting light intensity (focal point) is detected, and the light intensity/color information is obtained at this position. Based on this information, three types of images are generated: color + laser, laser only, and height/color map.



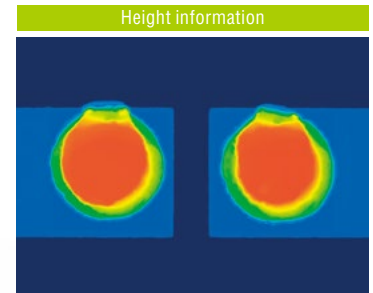
Three types of images built from laser scan



Color + Laser image
Fully-focused color image that SEMs and optical microscopes cannot provide.



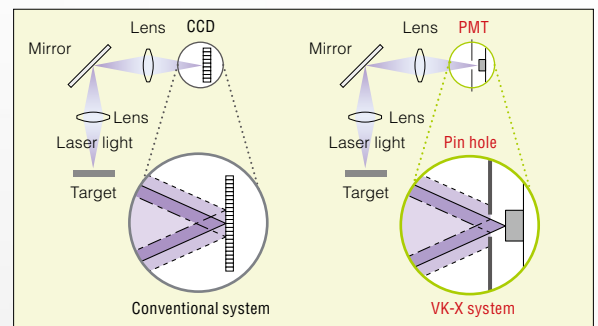
Laser intensity image
Black and white high contrast image that SEMs provide. Shows the reflectance differential on the surface of a target.



Height-Color Map Bump (1000x)
Different heights are marked by changes in color.

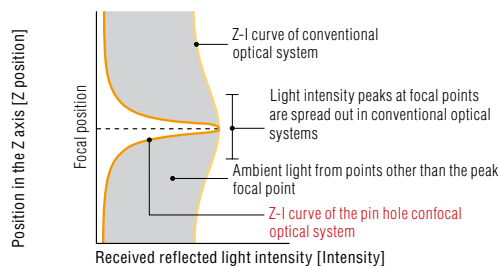
High accuracy measurement using the pin hole confocal optical system

Since reflected light from surrounding out-of-focus areas are collected when using a conventional optical system, it's difficult to achieve high-accuracy measurements or create high-definition images. A pin hole confocal system is designed to ignore non-focused areas of a target, allowing for nanometer-level height measurements and high-resolution color images.



Difference between a pin hole confocal system and conventional systems

Peak detection (focal point) comparison between a pin hole confocal system and conventional system.



Conventional optical systems receive reflected light from areas outside of the peak focal point. With a confocal system, only light from the focal point is collected, producing a sharper image.

Optical film (1000x)

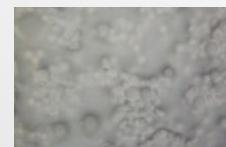
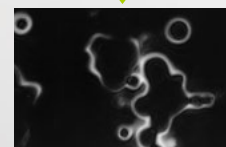


Image from a conventional optical microscope
Defocused light and flare cannot be removed.



Confocal image from the VK-X
Only displays the area that's in focus, while eliminating defocused information.

3D Surface Profiler VK-X Series

0.1 nm Z-axis measurement resolution on virtually any material with up to 28800x magnification



Ease-of-use of an optical microscope

Analysis functions of an SEM and roughness gauge with the convenience of an optical microscope

- Requires no target preprocessing such as vapor deposition or cutting.
- Just place the sample on the microscope stage and start viewing/measuring.
- Adjust the examination positions while checking the image from the optical microscope.



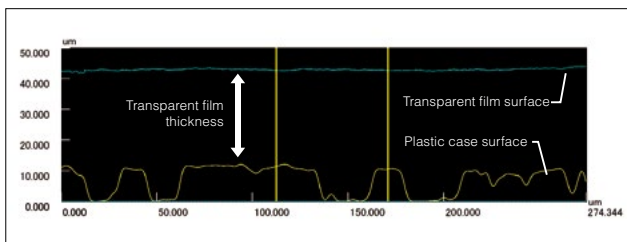
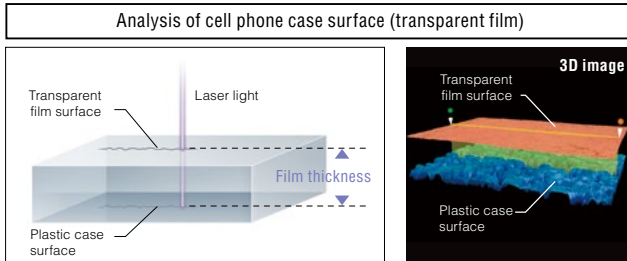
Just place the target object on the stage

Allows examination of large samples

Transparent object observation function

Acquire laser reflection information from each layer of a transparent object

- Surface observation of each layer
- Profile observation of each layer
- 3D image display of each layer
- Thickness measurement of transparent object

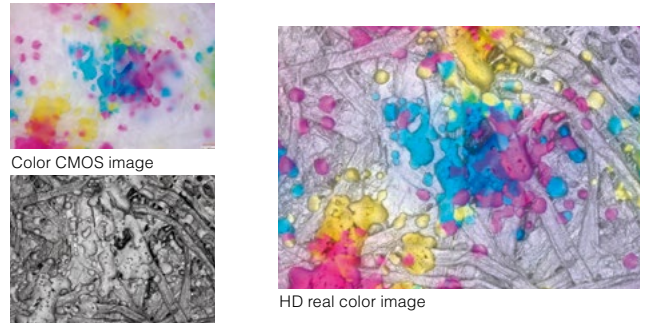


Transparent film surface + cross-section plastic case surface profile

High resolution color imaging with up to 28800x magnification

White-light source and short-wavelength laser source for optical and laser image

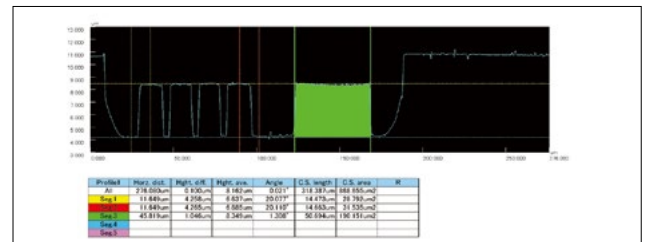
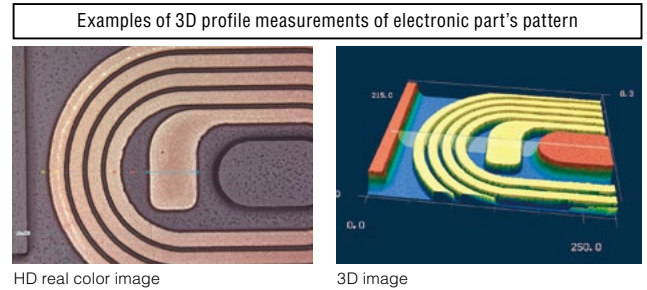
- Achieve real color observations.
- Magnification up to 28800x.
- Fully-focused images throughout the entire viewing range.
- Allows non-contact thickness measurements of transparent objects.



Non-contact 3D measurement

The traceability-compatible system allows no-contact measurement of 3D profile of the entire observation field

- Measures height, angle, radius-of-curvature, and area from the cross-section profile.
- Line/plane roughness measurement
- 3D measurement of the volume/surface area
- Comparison measurement with other data



Profile analysis screen



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SAFETY INFORMATION
 Please read the instruction manual carefully in order to safely operate any KEYENCE product.

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