EVIDENT™

Microscope Solutions

Electric Vehicles

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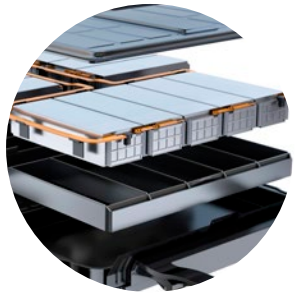
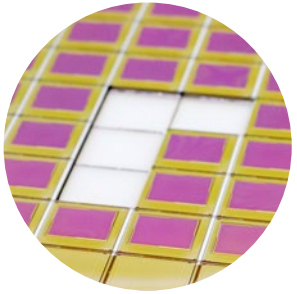




Lithium-Ion Batteries

Lithium-ion batteries are known for their light weight, high energy density, and high battery capacity and efficiency compared with other batteries. However, they need to be inspected carefully to avoid overheating and the risk of fire or explosion.

Burr Inspection

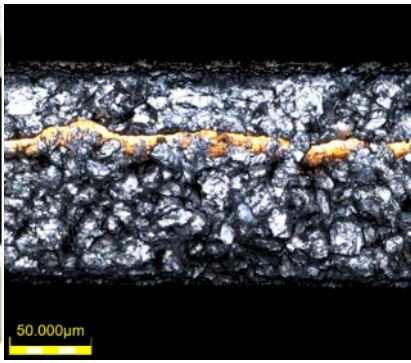
Application & Challenges

A burr on a lithium-ion battery's electrode material or current collector can result in an electrical short risk, and it may overheat and even ignite during operation. Therefore, batteries need to be strictly inspected for burrs to help ensure their safety.

Solutions

- Many lithium-ion-battery manufacturers around the world use Olympus industrial microscopes because of their proven efficiency and reliability.
- With our DSX1000 digital microscope, you can switch between six observation modes—BF, DF, MIX, OB, POL, and DIC—with a single click or push of a button, so you can easily select the mode that offers an optimal view of the sample.
- The DSX1000 microscope's EFI function enables you to focus on the entire surface, from the bottom to the top, even if the cross section is uneven.
- You can use our STM7 measuring microscope to observe and measure samples that are up to 175 mm in height with guaranteed accuracy.*
- Using the STM7-BSW software, the STM7 microscope can also bring into focus entire surfaces with uneven cross sections, from the bottom to the top.

Electrode material or current collector



Cross section of current collector

Recommended Products

DSX1000 Digital Microscope, STM7 Measuring Microscope

*Based on conditions set by Evident

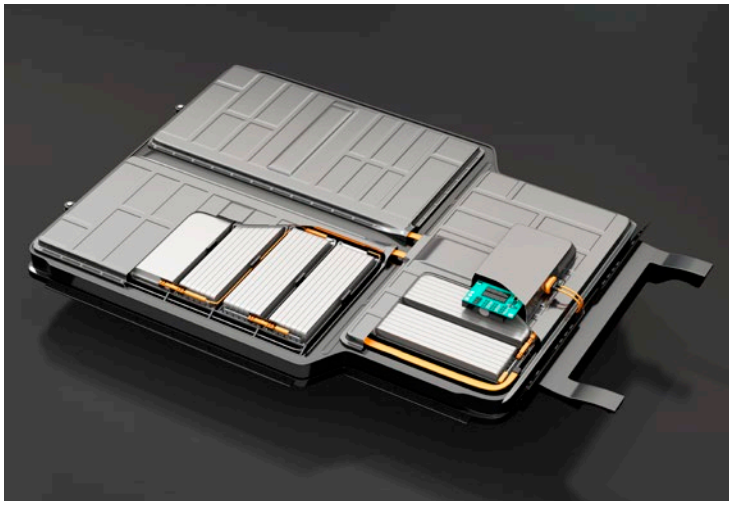
Metal Contamination

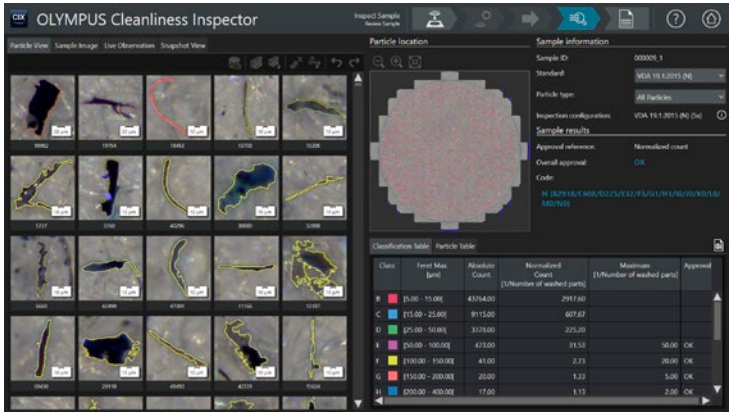
Application & Challenges

Lithium-ion batteries used in hybrid and electric vehicles (EVs) have been known to overheat and even ignite during operation. This fire hazard is largely attributed to metal contamination during the battery manufacturing process, which can lead to an eventual electrical short circuit. Thorough and reliable metal contamination analysis is therefore a critical aspect of technical cleanliness inspections performed on lithium-ion batteries for the automobile industry.

Solutions

- With its high-performance industrial microscope and versatile dedicated software, the OLYMPUS CIX100 system can acquire an image of contamination in a lithium-ion battery and classify and measure the size of each contaminant particulate.
- The CIX100 system's optimized contamination analysis functionalities with easy-to-use workflows enable you to inspect test samples quickly and reliably, minimizing variation between operators.
- Olympus' high-quality industrial objectives enable the detection of microscopic contaminant particles as small as 2.5 µm (and up to 42 mm) in size.
- Microscope mode enables you to exit the dedicated cleanliness inspection workflow to perform microscopic imaging. Expand the microscope mode capabilities with optional material analysis solutions, such as Grain Intercept, Grain Planimetric, Cast Iron, Inclusion Worst Field, Layer Thickness, Dendrite Arm Spacing, Phase Analysis, Porosity, and Coating Thickness.





Recommended Products

CIX100 Technical Cleanliness Inspection System

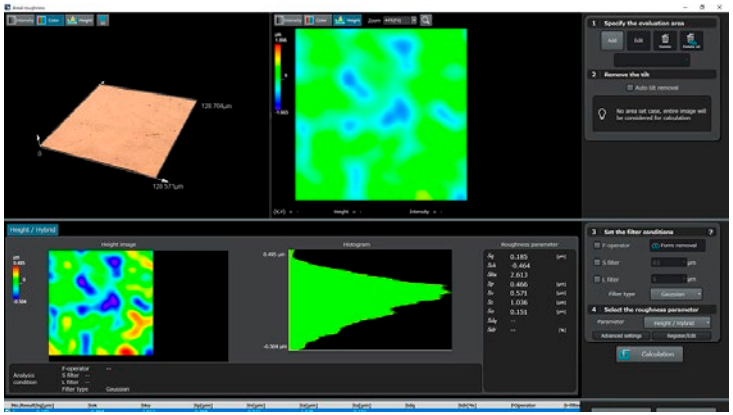
Roughness Measurement

Application & Challenges

The electrode material and the current collector must have high adhesion in order to maintain stable battery capacity. The appropriate roughness level of the current collector depends on the type of electrode material applied. Evaluating the roughness of the current collector is important for Li-ion battery quality control.

Solutions

- Since it uses a noncontact measurement process, the LEXT™ OLS5100 microscope mitigates the risk for damage to even soft surface samples such as current collectors, as opposed to contact measurement using a needle-type roughness meter. In addition, the data accuracy is not impaired.
- LEXT dedicated objective lenses acquire accurate data without the influence of aberrations, not only at the center of the field of view but also at the periphery.
- The roughness of the current collector is closer to the actual value when the data acquisition area is wider. Therefore, there is a need to stitch multiple fields of data views. The LEXT OLS5100 stitched data's accuracy is guaranteed,* making the data more reliable.



Roughness measurement of the copper foil of a negative electrode collector

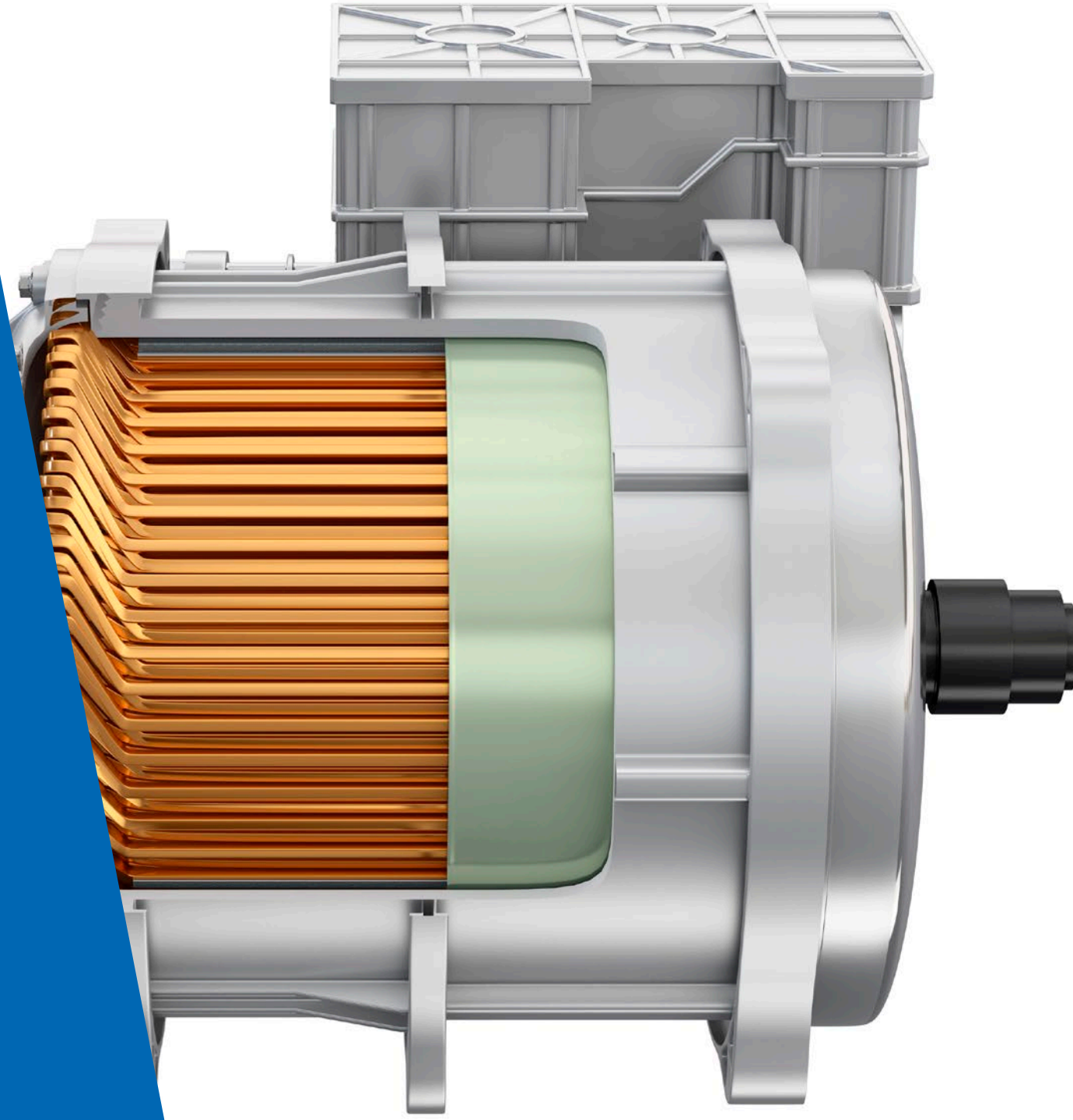
Recommended Products

OLS5100 Laser Scanning Microscope

*Based on conditions set by Evident

Motor

An electric motor is a device that converts electricity from a battery into driving force. The motors used for EVs have characteristics such as high starting torque, high power density, and good efficiency.



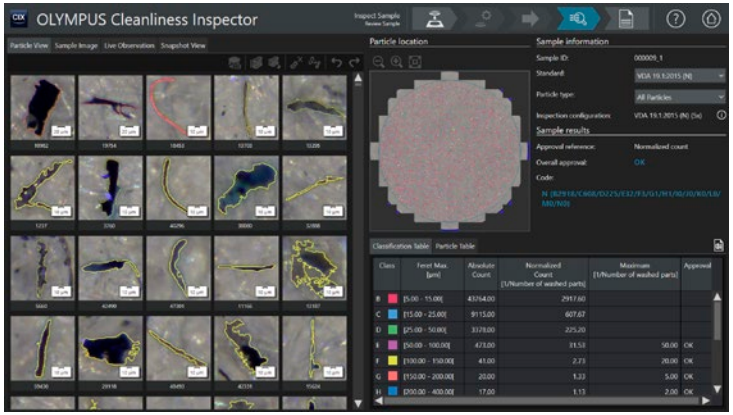
Metal Contamination

Application & Challenges

The cleanliness of the motor shaft has a significant impact on the performance and durability of the electric motor. Since the shaft is in constant contact with the bearing of the motor during an EV's operation, the effects of friction cannot be avoided. The friction between the shaft and bearings deposits a metal powder on the motor shaft, affecting the durability and performance of the motor. To check if metal powder remains on the shaft, quality management inspectors can use our technical cleanliness inspection system.

Solutions

- The CIX100 technical cleanliness inspection system incorporates an industrial microscope with high optical performance, minimizing the risk to miss detecting contamination.
- Its unique polarization optical system simultaneously detects metal and nonmetal particles in contamination with a single scan.
- The camera and optics are protected and preconfigured, eliminating false detection due to misalignment of the units.
- Complies with VDA19.1 (German quality management system standard), the international equivalent of ISO 16232.



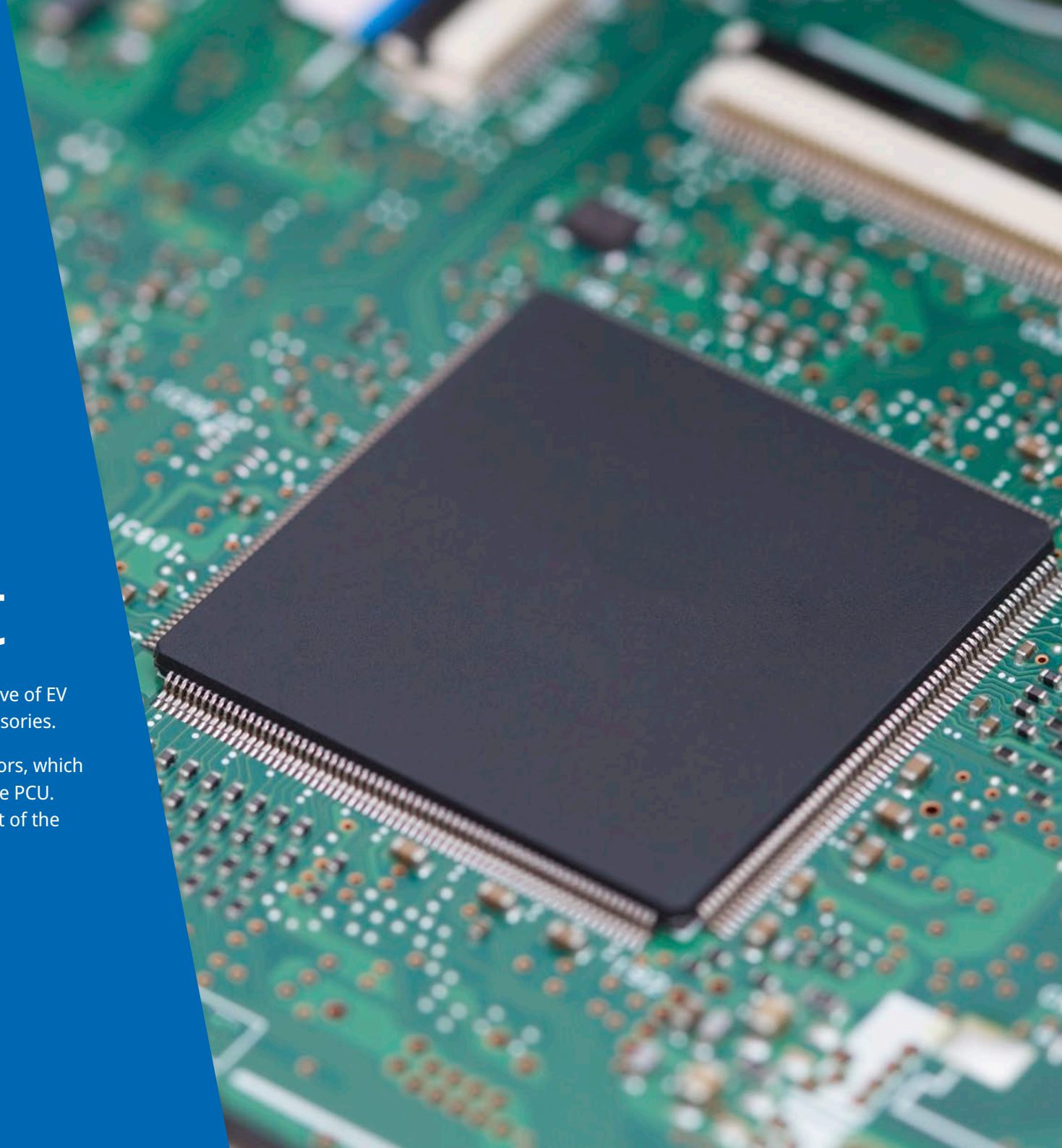
Recommended Products

CIX100 Technical Cleanliness Inspection System

Power Control Unit

A power control unit (PCU) is a device that controls the drive of EV electrical components, such as the motor and other accessories.

The PCU contains components called power semiconductors, which are used to control and route the electrical power from the PCU. Microscopes are used to detect defects on the PCU as part of the manufacturing quality control process.



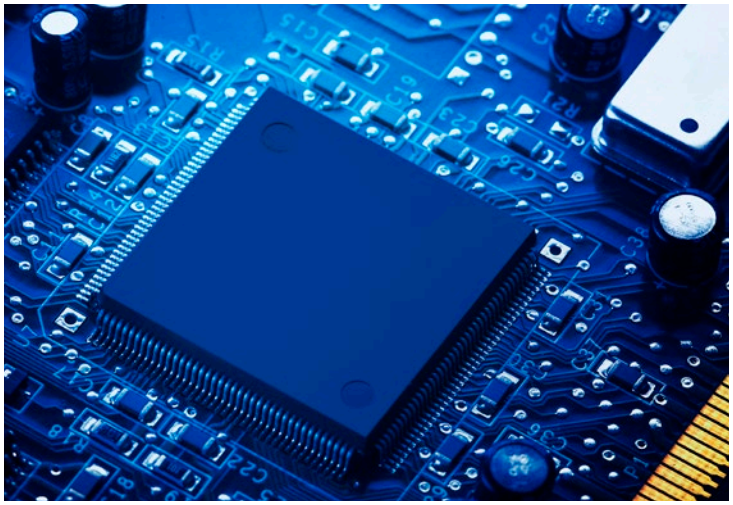
Power Semiconductor

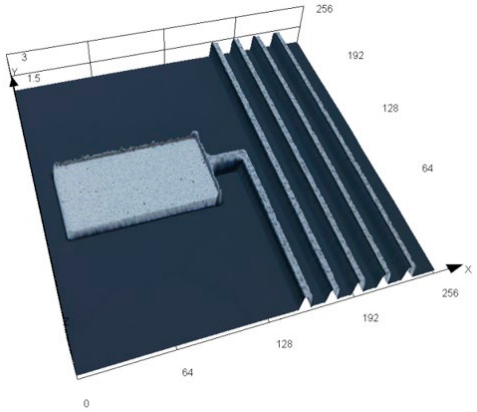
Application & Challenges

Silicon carbide (SiC) wafers are used as a substrate for power semiconductors, and inspectors need to check the dimension of the SiC wafer's pattern and measure the pattern trench after etching. The patterns are incredibly small with a trench size of around 1 µm, so a microscope capable of high accuracy is required.

Solutions

- The LEXT™OLS5100 laser scanning microscope is capable of precision 3D measurements with a 0.12 µm lateral resolution, enabling inspectors to measure the dimensions and height of SiC wafer patterns with high accuracy at the submicron level.





Pattern on an Si wafer

Recommended Products

OLS5100 Laser Scanning Microscope

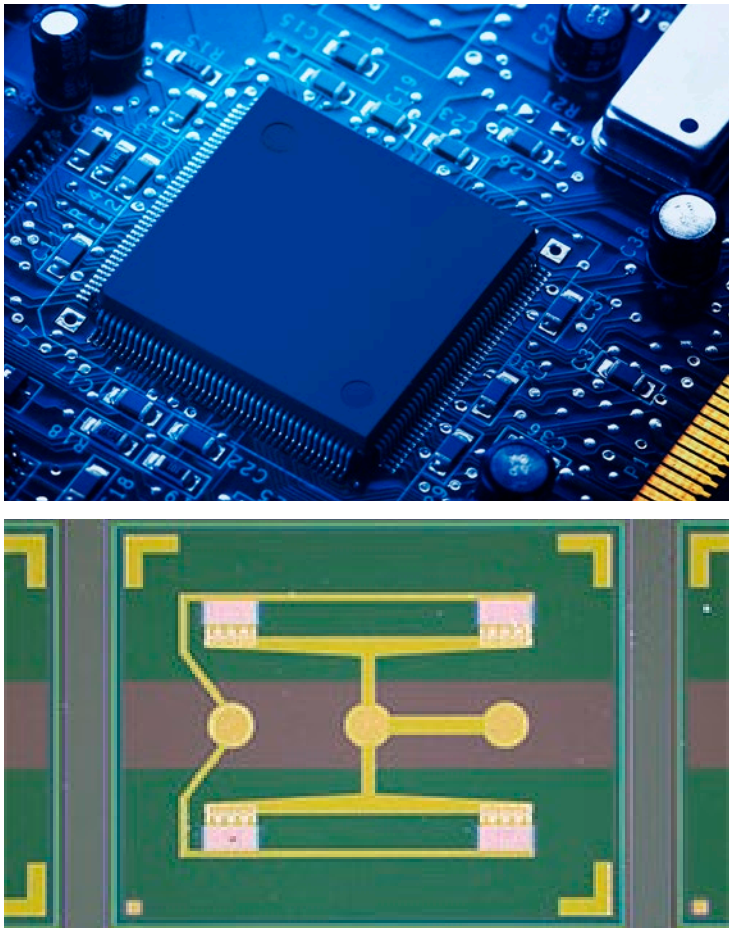
Power Semiconductor

Application & Challenges

When microscopic observation of both the circuit pattern and color of a wafer sample is required, the conventional method calls for darkfield illumination for the former and brightfield illumination for the latter, with repeated switching between the two techniques. This method of observation is time consuming because image acquisition is required for each technique when creating a report.

Solutions

- MX63 industrial microscopes provide an efficient alternative to conventional observation methods: the MIX lighting function. With MIX illumination, circuit patterns and the color information of wafers can be observed simultaneously. The sharpness and clarity of the MIX image help improve work efficiency and report creation.



Pattern on an Si wafer

Recommended Products

MX Series Semiconductor Microscopes

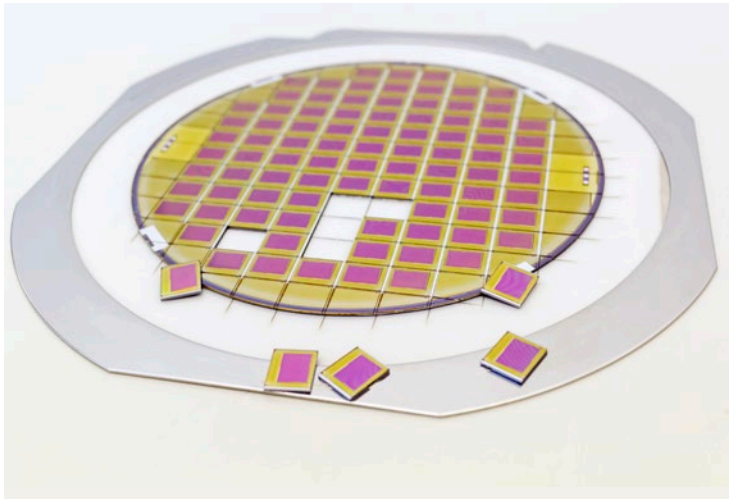
Power Semiconductor

Application & Challenges

Defects are sometimes introduced into wafers during their fabrication because of degradation of the manufacturing equipment, inadequate equipment adjustment, human error, or contamination. As these defects can be extremely small, microscopic inspection is required to detect them.

Solutions

- The MX™ series and DSX1000 microscope are efficient tools for wafer defect inspection. Using low magnification, the microscope operator can select a useful observation method for defect detection and then confirm the type of defect under high magnification.
- The DSX series with its customized large stage is a versatile and user-friendly system for wafer defect detection. It enables you to easily switch between six observation methods with the touch of a button, and you can select the optimal image from a gallery displaying all six methods.



Wafer defect DIC observation

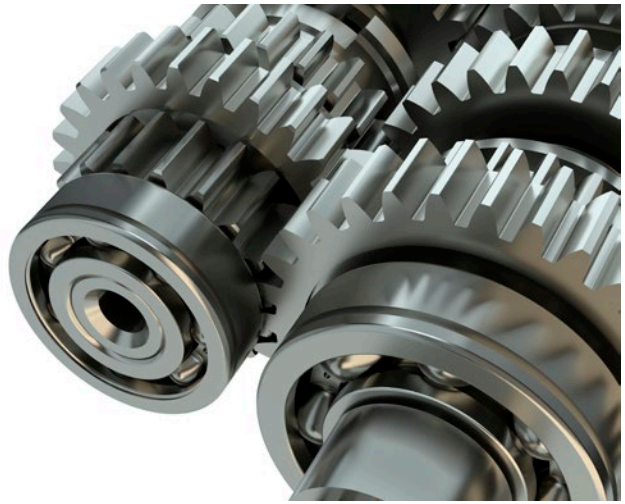
Recommended Products

DSX1000 Digital Microscope, MX Series Semiconductor Microscope

Gears & Bearings

Like with gasoline engines, gears and bearings are key components of electric vehicles.

Roughness Measurement of Gears

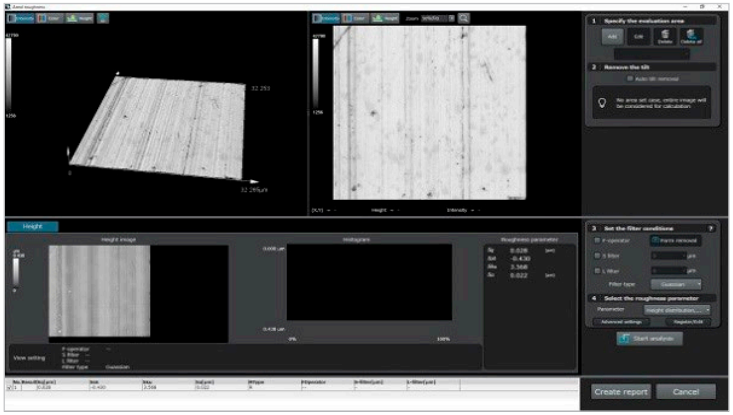


Application & Challenges

Electric motors make EVs much quieter than gasoline-powered cars. However, components such as gears can increase the EV's driving noise level. For this reason, the gear teeth used in EVs are subjected to stringent surface roughness requirements. The tools used to validate the surface roughness of gear teeth need to be capable of high accuracy to meet these demands.

Solutions

- Because the laser microscope's roughness measurement is planar based (not merely linear), color and laser images and 3D profile data can be obtained simultaneously, making your analysis of gear teeth roughness more extensive than with a stylus-based system.
- Our laser scanning microscope is equipped with a function that horizontally stitches various kinds of data, enabling you to quickly measure a wider field of view with high accuracy.



An example of roughness measurement on the groove of an inner ring (long working distance 100X objective lens; 4x optical zoom)

Recommended Products

OLS5100 Laser Scanning Microscope

Roughness Measurement of Bearings

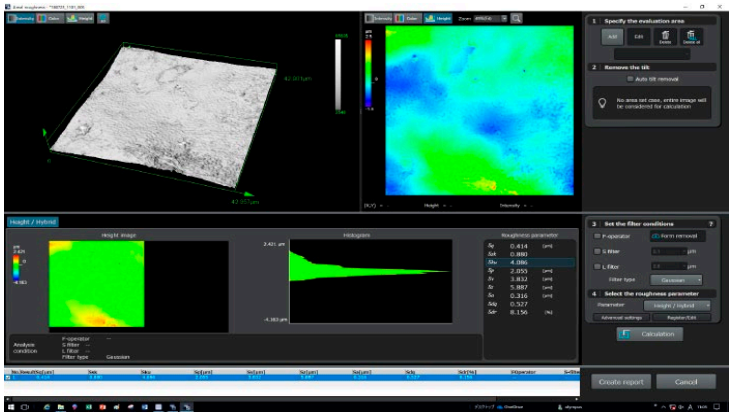
Application & Challenges

Bearing balls roll at high speed through the raceway formed by grooves in the inner and outer rings of a ball bearing assembly. In quality control, it is important to accurately evaluate the roughness of both the balls and the grooves.

If a conventional microscope is used to evaluate roughness, the working distance of the objective lenses may be too short to allow clear focusing on the bottom of the grooves, which can prevent accurate measurement.

Solutions

- The LEXT™ OLS5100 microscope is equipped with dedicated long working distance objective lenses for roughness measurement on grooves up to 6.5 mm deep.
- Noncontact and high-precision measurement of gear teeth and bearing surface roughness.
- The surface is scanned with a 0.4 µm diameter laser light to acquire highly precise data, enabling measurement of minute gear teeth and bearing roughness that is difficult to measure with stylus-based contact instruments.
- Planar roughness measurement can obtain color, laser images, and 3D profile data simultaneously, making analysis of gear teeth and bearing roughness more extensive than with a stylus-based instrument.



Gear teeth surface roughness measurement example (using a replica; 100X objective lens; 3x optical zoom)

Recommended Products

OLS5100 Laser Scanning Microscope

Evident Microscope Solutions

Microscope Solutions: Electric Vehicles

OLS5100 – Features and Benefits

Overview

The LEXT™ OLS5100 3D laser microscope precisely measures shape and surface roughness at the submicron level. Data acquisition that is four times faster than our previous model* delivers a significant boost to productivity.

Guaranteed Measurement Accuracy

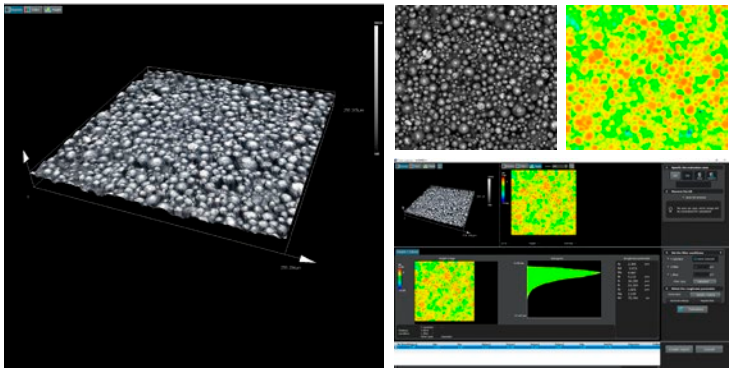
- Guaranteed accuracy is based on conditions set by Olympus
- Renowned Olympus optics reduce aberration to capture the correct shape of your sample throughout the entire field of view
- Smart Lens Advisor helps you choose the right objective lens for your roughness measurement

Easy Laser Scanning Microscopy

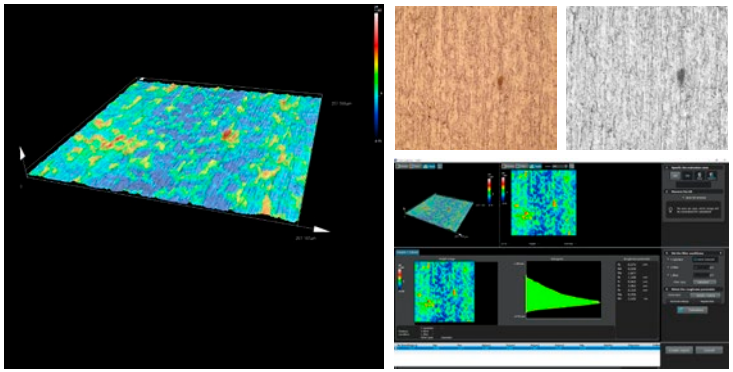
- Acquire accurate data easily: put your sample on the stage and press the start button
- Measurement performance guarantee* tailored to your operating environment

Material Engineering and Failure Analysis Experiments

- Automatically creates your experiment plan
- Automatically populates data to your experiment plan matrix, reducing the chance of input errors
- Clear data trend visualization tools



Lithium-ion battery electrodes / area roughness



Copper foil / area roughness

*Based on conditions set by Evident

DSX1000 – Features and Benefits

Overview

The DSX1000 digital microscope combines world-class macro- and micro-optics in one system. With 23X to 8220X magnification, it can be used for sample inspection and sample preparation at low magnification as well as detailed microstructure analysis at high magnification.

Macro to Micro Versatility

- See the whole picture with its 23X to 8220X magnification range
- Minimize the chance of crashing into your sample
- See your sample from many angles

Multiple Observations with a Single Click

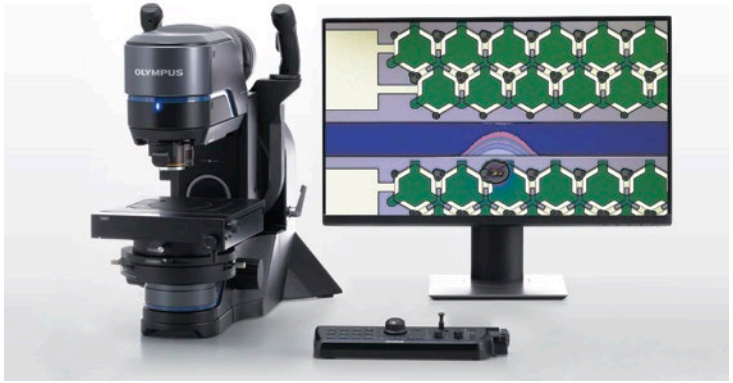
- All observation methods are available at all magnifications
- Choose from 6 observation methods, and switch them with a single click

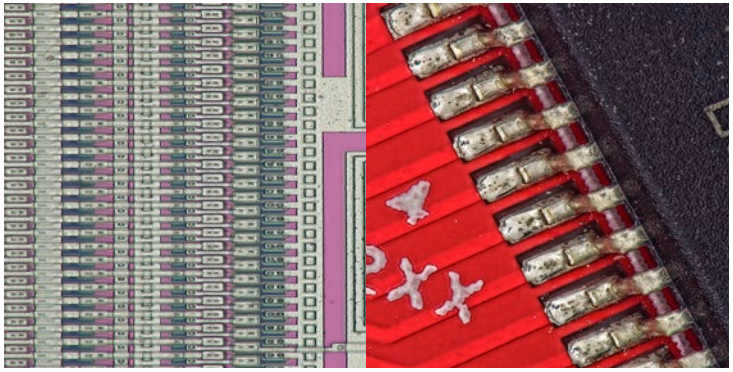
Be Confident in Your Results

- You can be confident in your measurement results with guaranteed* measurement precision
- Reliable measurement with on-site calibration

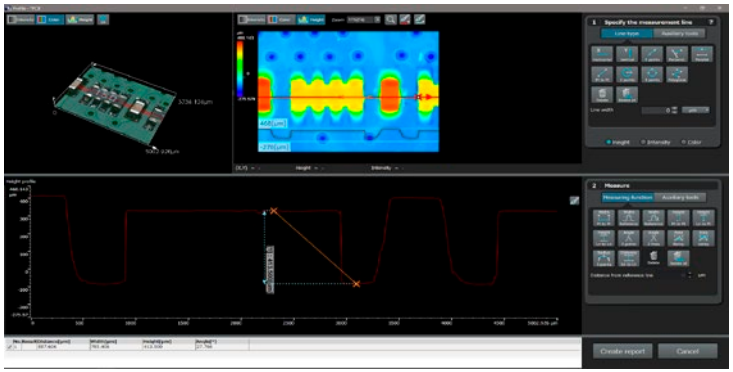
Fast and Easy Advanced Measurements

- Supports complex measurement, including surface roughness,
- Faster analyses with advanced easy-to-use functions





Wafer wiring PCB ASSY



*To guarantee XY accuracy, the calibration must be performed by an Evident service technician.

CIX100 – Features and Benefits

Overview

The OLYMPUS CIX100 system is a dedicated turnkey technical cleanliness solution. Quickly acquire, process, and document particulate residue data of manufactured parts to comply with company and international standards.

Simple and Reliable

- Repeatable results from a stable measurement system setup
- Full system integration for automated control of all hardware components

Intuitive Guidance for Maximum Productivity

- Dedicated, simple workflows minimize user action and provide reliable data
- All data are saved automatically and can be easily exported and shared
- Separate microscope mode with optional material analysis solutions

Fast Live Analysis

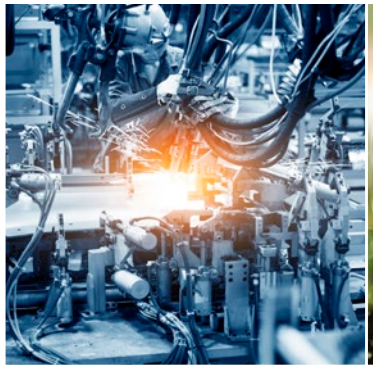
- Automatic live processing and classification of contaminant particles ranging from 2.5 µm up to 42 mm
- Compliant results are customized to the selected industry standards

Efficient Data Evaluation

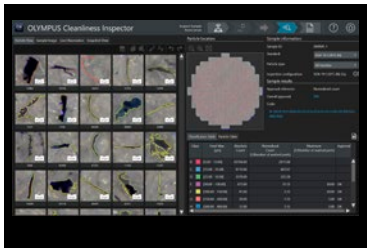
- Particle locations and thumbnails are linked to the live images
- Live display of the overall cleanliness code, particles, and classification tables

Compliant Report Creation

- Generate professional reports with predefined, compliant templates
- Supports various output formats, including MS Word and PDF



Integrated calibration standard helps maintain regular system verification



Inspection data at a glance

*To guarantee XY accuracy, the calibration must be performed by an Evident service technician.

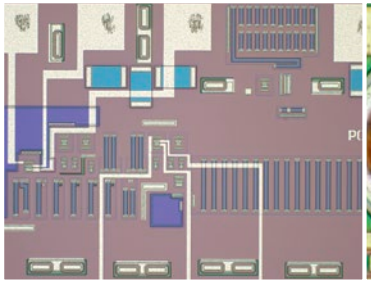
STM7 – Features and Benefits

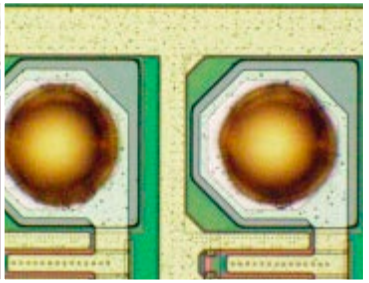
Overview

Whether samples are small or large, simple or complex, or measurements are being taken by a novice or an expert, the Olympus STM7 range features measuring microscopes tailored to fit your needs.

Refined Optical Performance

- The STM7 series uses the same UIS2 infinity-corrected optical system found in state-of-the-art optical microscopes
- Aberration is eliminated so observed images have high resolution and high contrast, enabling highly accurate measurement in minute detail



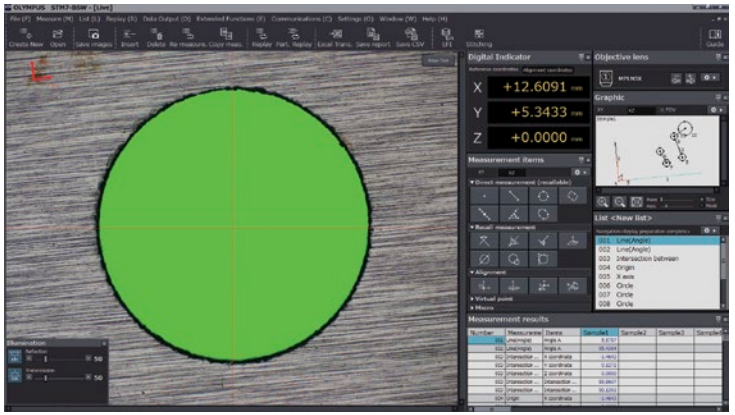


Reliable Measurements with a Stone Stage-Mounting Plate

- To further improve measurement accuracy, the STM7 series uses a highly durable, vibration-resistant frame with a granite surface plate
- This stability enables submicron level measurements and reduces the risk for error

User-Friendly, High-Precision, 3-Axis Measurement

- As modern manufacturing technology becomes increasingly miniaturized and precise, highly accurate measurements are even more essential not only along the XY axis, but also along the Z axis
- We responded by creating the first reflective active, confocal autofocus system



Dependable Quality Based on a Strict Traceability System

- The accuracy of our measuring microscopes is controlled by a strict traceability system, and we offer traceable calibration during installation

*To guarantee XY accuracy, the calibration must be performed by an Evident service technician.

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