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Excelitas extends capabilities beyond traditional machine vision



Arthur Stauder, Product Manager Imaging Optics at Excelitas, believes that the company was able to demonstrate at the recent VISION it is significantly strengthening its position. 'By combining advanced optics, microscopy, illumination, and imaging technologies, we can address increasingly demanding inspection challenges across the semiconductor manufacturing ecosystem,' he says (Image: Excelitas)

At VISION 2026, Excelitas showcased a range of advanced inspection and imaging solutions designed for next-generation industrial applications. Among the highlights were two demonstration systems that underscored the company's expanding capabilities in semiconductor inspection, automated microscopy, and short-wave infrared (SWIR) imaging.

According to Arthur Stauder, Product Manager Imaging Optics at Excelitas, the exhibits reflected a broader strategy to extend the company's presence beyond conventional machine vision applications.

"These demonstrations show that our expertise today goes far beyond traditional industrial imaging," said Stauder. "By combining advanced optics, microscopy, illumination, and imaging technologies, we can address increasingly demanding inspection challenges across the semiconductor manufacturing ecosystem."

High-resolution wafer inspection at sub-micron scale

The first demonstration combined the Optem® mag.x 125 high-resolution microscopy platform with the new 105-megapixel pco.pixelfly 105 bi CLHS camera designed for a large field of views.

The Optem mag.x 125 is a wide-field microscopy system engineered to deliver exceptional optical performance across an unusually large field of view. By combining a highly optimized optical design with precision Köhler illumination, the system maintains excellent contrast and image quality across the entire sensor area, including the outer edges of large-format sensors.

A key feature of the platform is its integrated autofocus technology, which provides the speed, accuracy, and reliability required for automated metrology and inspection environments.

The PCO camera platform targets applications including semiconductor and wafer inspection, flat-panel display manufacturing, electronics production, automated optical inspection (AOI), digital pathology, metrology, and other large-area imaging tasks.

For the VISION demonstration, Excelitas focused specifically on semiconductor wafer inspection.

"We are using a newly developed Optem mag.x 8x objective with a numerical aperture of 0.32 to resolve fine wafer structures," explained Stauder. "The image is relayed through the tube lens system onto a 105-megapixel image sensor with a pixel size of 2.74 µm. This system can achieve sub-micron resolution on a large field-of-view."

Illumination is provided by an Excelitas' X-Cite® light source, integrated with dedicated optics to ensure highly uniform and homogeneous lighting conditions across the inspection area. The system also incorporates a laser-based autofocus sensor from WDI.

"The laser signal is projected through the objective and optical path onto the target surface and returned to the sensor," said Stauder. "This allows the focus actuator to be controlled within a closed-loop system at very high speed and with exceptional precision. The working distance is continuously adjusted so that the sample remains in focus even while moving. This capability enables high-throughput inspection of wafers, flat panels, and advanced packaging structures."

Although the exhibited solution utilised an area-scan camera configuration, the platform can also be adapted for line-scan imaging applications. This flexibility met with great interest among the trade visitors.

SWIR imaging reveals hidden semiconductor defects

A second demonstration focused on short-wave infrared (SWIR) imaging, enabling the detection of defects and structures that are invisible under conventional visible-light inspection.

At the core of the system was the pco.edge 1.3 SWIR CLHS camera, which combines ultra-low readout noise, high quantum efficiency, deep sensor cooling, and high-speed image acquisition. The camera features a 1,280 × 1,024-pixel InGaAs sensor with a 10 µm pixel pitch and frame rates of up to 148 fps. Its spectral sensitivity extends from the visible region into the SWIR spectrum, covering wavelengths up to 1,700nm.

With a typical read noise of only 25 electrons and sensor cooling down to -30°C, the system is capable of highly sensitive and low-noise imaging, even during longer exposure times. Potential applications range from fluorescence microscopy and hyperspectral imaging to semiconductor inspection, advanced packaging analysis, and scientific imaging.

Complementing the camera is Excelitas' new LINOS® Rodagon SWIR objective lens. "This is our first Rodagon lens specifically designed for SWIR applications," Stauder noted. "The optical design minimises focus shift between NIR and SWIR wavelengths, enabling stable and highly repeatable measurements without refocusing. The lens is apochromatically corrected from 900nm to 1,750nm, making it well suited for demanding SWIR inspection tasks."

In the demonstration setup, a SWIR illumination source positioned beneath the wafer transmitted light through the silicon substrate. Because silicon becomes transparent at SWIR wavelengths, internal structures that remain hidden in visible-light inspection can be

visualised. "This enables the detection of internal defects and the visualisation of specific vertical interconnect structures," said Stauder. "In simple terms, we make the invisible visible."

A similar concept was previously demonstrated at Photonics West, where Excelitas showcased hyperspectral imaging capabilities based on its Optem Fusion SWIR microscopy platform. "Ultimately, we can tailor the system to virtually any backend semiconductor packaging application," Stauder added.

Expanding into new imaging markets

Stauder believes that Excelitas has significantly strengthened its position since the previous VISION exhibition.

"We have long been recognised for our expertise in optical inspection and imaging, particularly in machine-vision-based quality control and sorting applications," he said. "With our latest microscopy, optical, and SWIR technologies, we are expanding into new markets, including automated microscopy, micro-inspection, and imaging beyond the visible spectrum. These innovations open new opportunities in semiconductor manufacturing and reinforce our position as a technology leader in advanced inspection solutions."