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Take a Deep Dive into your Process with Neptune

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Past missions to the "final frontier" might have been more successful if the coating on the electronic assemblies had been measured using our Neptune. While this is just a hypothetical statement, it is highly likely that in a harsh environment like outer space, some effects such as crystal growth and surface contamination can occur. As such, sealing the electronics assembly from environmental contaminants is particularly important, because any debris or moisture can form the breeding ground for crystal dendrite growth.

Harsh environments are not limited to space, electronics need protection on earth too. Consider the engine compartment of your vehicle, or the drive in an offshore wind turbine, the motor on an e-bike, or your mobile device. The assemblies must be protected to prevent damage from environmental elements; yet the protection process itself can become the challenge or even the reason for product failure in the field.

On an unprotected electronics assembly, debris and moisture form a conductive mixture that shortens the insulation distances and causes failure. Moisture also causes corrosion. Conformal coating is intended to protect the assembly from these dangers. However, if the debris or moisture is captured within the conformal coating, the danger lies dormant under the supposed protection. Bubbles and air pockets are also predetermined breaking points in the protective layer. Koh Young now provides a solution to these failure opportunities with its Neptune dispensing process inspection (DPI) solution.

Failure Modes

Conformal coatings isolate and protect electronics from moisture, debris, corrosion, and shock and add mechanical stability to reduce failures and improve reliability in harsh environments like automotive, LED, military, aerospace, medical, mobile, and more applications. But what if the coating is too thin or defective? Failure.

Here are some common failure modes the dispense process inspection (DPI) systems like can detect:

- When entrapped air or solvents skin over, often caused during the drying process or multi-layer coating application, **bubbles** become entrapped before settling out. These types of systems should be able to detect bubbles measuring length or percentage of affected area.

- **Cracks** leave an area exposed and less protected from moisture and dust. It usually happens when the curing temperature is too high or when curing occurs too quickly, and if combined with a thick coating application, it causes fracturing of the coating into sections. If a crack turns in a bigger affected area, now we will have a delamination problem, that also can be created by a printed circuit board (PCB) cleanliness issue. For both situations, the DPI system should detect the cracks or delamination defects by measuring the length or calculating it as a percentage of affected area.

- **Conformal coating thickness** can present two problems, one related to a too thick coating, and other related to a thin coating layer. For these scenarios, measuring thickness can find common defects caused by a wrong coating thickness. These include capillary flow, de-wetting, and uneven coating, which is a challenging defect to detect with the old traditional measuring technologies and is usually a destructive test. A patented technology – LIFT (laser interferometry for fluid tomography) – can solve this issue and accurately measure coating thickness at full production speed without damaging the product.

- A bad coating application can leave **particles in orbit** that may result in a short circuit or can reduce the PCB protection from environmental contaminants like dust, moisture, and corrosive vapors. In some products, conformal coating is applied to give some structural integrity.

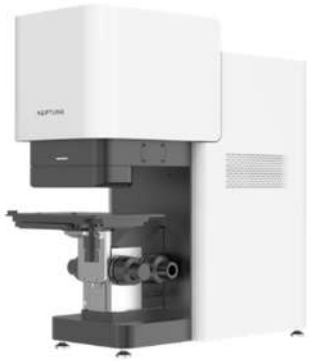
If there is not a good detection of coating defects, PCBs, as a part of a final assembly, can have a reduced lifetime, or even worse, a malfunction during a regular operation. Consider some modules in a car, which are composed of several PCBs and require strong bonds. These can use conformal coating to protect against vibration and mechanical shocks. If this protection is inadequate or defective, it could cause a life-threatening accident because of an electronic module malfunction that was supposedly protected by a conformal coating treatment. Therefore, measuring thickness is a critical quality assessment tool that must be completed through non-destructive testing at production speed.

Inspection Solutions

Traditional laser-confocal or electron microscopes only measure three-dimensional shapes and cannot inspect transparent materials. The microscope penetration depth is too shallow, and the processing time is quite lengthy, so measuring transparent materials is a significant challenge due to the laser's shallow penetration depth and elapsed time. UV-based systems also gauge material thickness in a particular spot, which does not deliver the accuracy and repeatability needed.

Tabletop DPI Solution

The Neptune T from Koh Young is a pioneering system that cleverly uses non-destructive 3D inspection technology to examine the thickness of transparent and semi-transparent materials like coatings, underfill and epoxy used on a PCB. This ensures the conformal coating used to protect the delicate circuitry is applied correctly and will ensure the device operates as it should.



Expanding on the capabilities, the core system has advanced to the next phase with both batch and inline conformal coating inspection systems using data aggregation and data-driven processes to help manufacturers dive deep into the DPI process.

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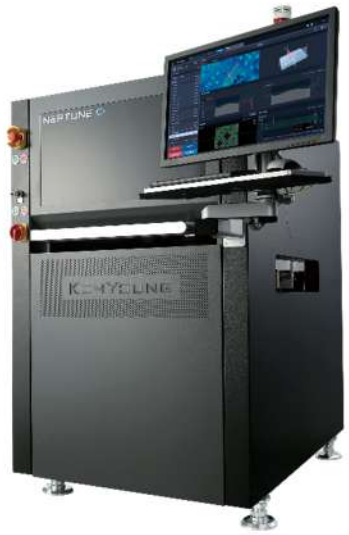
Inline DPI Solution

Some systems like the new Neptune C+ provide a novel approach to these challenges. With its patented LIFT technology, it is the industry's first 3D in-line optical measurement solution to inspect transparent materials. Most system can measure materials for coverage and consistency, but the Neptune adds comprehensive thickness measurement with user-defined threshold settings. Other systems in the market measure IC leads with a single-point method, resulting in unreliable, inconsistent results. The Neptune Series is groundbreaking – measuring the actual coating thickness to satisfy demanding quality standards at full speed.



LIFT (Laser Interferometry for Fluid Tomography)

With the help of Laser Interferometry for Fluid Tomography, or LIFT for short, the layer thickness of transparent media is determined within seconds. This LIFT technology delivers non-destructive 3D inspection to precisely measure and inspect fluids. The patented LIFT technology delivers non-destructive 3D inspection to precisely measure and inspect fluids that are wet or dry. Based on low-coherence interferometry, LIFT employs Near Infrared (NIR) Light to capture images through multiple layers of a fluid structure regardless of transparency. This exclusive technology provides the most accurate and reliable 3D inspection across any surface – smooth, uneven, or rough. Using LIFT technology, manufacturers can quickly and accurately identify defects without damaging or destroying the product.

Machine Learning

When the system grows with Machine Learning (ML) algorithms, manufacturers can accurately measure materials for coverage, thickness, and consistency. Yet, the Neptune goes further. With a proprietary machine learning technology, the Neptune C+ offers enhanced capabilities enabling autonomous inspection without teaching or endless fine-tuning.

Intuitive Programming

Leading-edge programming software like the new system on the Neptune provides a hands-on user interface, which emulates a simple raster graphics editor and allows intuitive programming. Programming can be further simplified with a wizard-based graphical user interface. All parameters can be adjusted for quick setup and fast changeovers.

Beyond Coatings

Besides coatings, the leading systems should be capable to measure underfill, epoxy, bonding, glue, flux, and more while delivering accurate measurement across transparent, translucent, and colored materials. The system are typically suited for acrylic, silicone, polyurethane, water-based, UV-cure, and hybrid coatings with additional materials often available. The systems should typically handle applications spanning research labs to high-volume electronics inspection.

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Industry First

Joe Booth, Chief Executive Office at Altus Group, Ltd. said: "The inspection of transparent materials like conformal coating is extremely important to ensure quality control and ultimately guarantees that the device will function correctly in its given climate. Think of the impact 3D measurement had on AOI and SPI in comparison to 2D systems. Well, the Neptune brings 3D inspection to coating. Given how much critical electronics is manufactured globally, this product promises to be a game changer for process improvement and monitoring."

Joe Booth, CEO
Altus Group, Ltd.

Inspection systems used in electronics manufacturing could traditionally detect the presence of coating; however, the systems could not inspect the thickness at production speed. This missing element meant some PCBs passed through the production line without the correct protective layer.

"This advancement will be a huge quality improvement across material dispensing and help in the manufacturing of critical electronics," continued Booth. "Like the rest of the Koh Young family, we are looking forward to presenting the Neptune series to our customers. Together with Koh Young, we are ready to run sample testing to prove concept and expectations."

Neptune is an award-winning industry-first technology solving long-standing dispensing process inspection challenges.

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About Koh Young Technology, Inc.
Established in 2002, Koh Young pioneered the market by launching the first 3D Solder Paste Inspection (SPI) system using a patented dual-projection Moiré technology. Since then, it has become the global leader in 3D measurement-based SPI and Automated Optical Inspection (AOI) equipment for the electronics industry. Based on its True3D™ measurement-based inspection technology, Koh Young has developed innovative solutions for challenges with Machining Optical Inspection (MOI), Dispensing Process Inspection (DPI), and Semiconductor Packaging Inspection (MEISTER Series). Through its technology innovations, Koh Young has secured thousands of global customers, and maintains the largest global market share in the SPI and AOI markets. Additionally, by adopting its user-centric R&D activities, it continues to leverage core competencies and develop innovative solutions for new and existing markets. Its activities stem from the corporate headquarters in Korea to its global sales and support offices in Europe, Asia, and the Americas. These local facilities ensure it keeps in close contact with the market, and more importantly, its growing customer base to provide access to an award-winning network of inspection and measurement experts. Learn why so many manufacturers trust Koh Young for reliable inspection at kohyoung.com.

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