

# Wafer Surface Analysis

*Detecting the defects with laser solutions*

## The Challenge

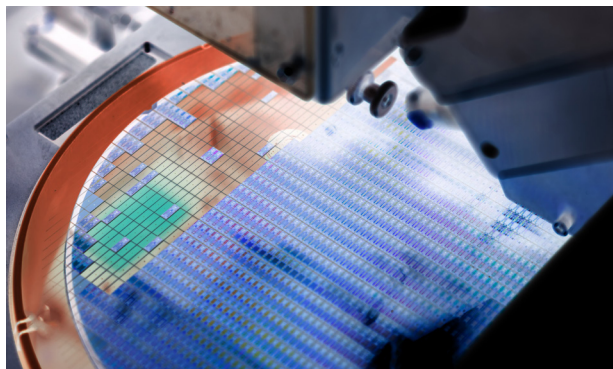
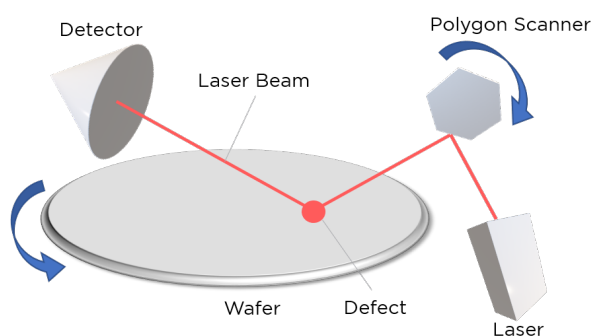
Semiconductors need to be inspected for defects during every part of the manufacturing process. Accurate and precise results are critical in order to prevent unnecessary product wastage and cost to the manufacturer. Many of the inspection processes associated with electronics inspection utilise lasers, due to the inherent levels of measurement precision and resolution that these inspection applications demand. Whilst the measurement and inspection value of laser based technology is unsurpassed, deploying such technology often presents a number of key challenges for the manufacturer:

- Requirement for reliable, long-lifetime lasers
- Maintenance free
- Passive, water-free cooling
- Unique laser speckle patterns
- Exceptional beam quality
- Zero laser power fluctuations
- Requirement to image smaller features

## What is Electronic Inspection?

Electronic inspection involves the detailed examination of critical components for surface defects or identifying marks. This technique is particularly prevalent in silicon wafer manufacturing, where the wafers are used in the manufacture of semiconductor microchips. At each stage of the semiconductor wafer process, detailed inspection needs to be performed to ensure that the manufactured product meets specification, and to identify even the smallest surface defects. The silicon wafer is inspected at least three times throughout the wafer manufacturing process:

- Upon creation of the semiconductor wafer
- Incoming Quality Control at the chip plant
- During and after development of the microchips



*Schematic of Semiconductor Wafer Inspection*

*Photograph of Semiconductor Wafer Inspection*

Any surface defect renders the chip unusable and is a cost to the manufacturer. If too many defects are detected, it is often more economical to stop production of that wafer early in the process and scrap it rather than let a defective wafer continue through the process. Lasers play a key role in semiconductor wafer inspection. During this process, laser light is rapidly scanned across the surface or edge of the silicon wafer using a high speed polygon scanner (such as those from Cambridge Technology); with any changes or deviation in the reflected light indicating a defect on the wafer.

## The Solution

In order to meet the demanding requirements of this application lasers need to be carefully selected. This ensures that their properties can be leveraged in such a way as to balance high throughput with accuracy, and can be rapidly scanned whilst ensuring absolute compliance to clean operating environments.

The axiom LE, is a new type of laser designed by Laser Quantum to precisely address this application. Axiom LE is a high power, air-cooled laser delivering 12 W of power without the need for liquid cooling – a feature which is widely prohibited in this application.

As with many mission-critical applications, 24/7 reliability together with long service lifetimes are required. Laser Quantum has a long heritage in developing lasers for mission-critical industrial applications, following a design philosophy that delivers the very highest performance and reliability over the longest lifetimes.

Designed with the semiconductor system builder in mind, Laser Quantum has designed the axiom LE laser specifically to address the requirements of wafer inspection, and is able to offer OEMs involved in wafer inspection a series of features that are unique to this application. Thanks to its novel cavity design, the axiom LE laser can be supplied with a customized bandwidth profile that is able to deliver a speckle pattern dedicated to the specifics of the inspection application, along with exceptional beam quality and active noise suppression.

Advanced integrated power feedback is a defining feature of all Laser Quantum products. With this feature, the laser is able to intelligently maintain and optimize its own power levels in order to maintain beam specification with no power fluctuations, making it truly the laser of choice for high reliability 24/7 wafer inspection applications.

With its strong focus on OEM integration, Laser Quantum understands the importance of hands-free, remote maintenance and service. For this reason, every Laser Quantum laser can be securely accessed from any location on the globe in order to optimize performance or to troubleshoot.



*axiom LE laser  
from Laser  
Quantum*

## Novanta Advantage

Through our photonics technologies, we deliver finely tuned laser sources and beam delivery systems that enable customers to improve their process, increase productivity and achieve breakthrough performance. We bring unprecedented value to our customers through engineer-to-engineer collaboration, a wide range of application expertise, and state-of-the-art application labs.

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