Novanta
PHOTONICS

WHITEPAPER

HIGHLY ACCURATE PARTICLE COUNTING USING LASERS

For Precise Results

Highly Accurate Particle Counting Using Lasers

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What is Particle Measuring?

Particle measuring is the process of counting and sizing particulates in a sample and is performed in either air or liquid. This technique is prominent in industrial processes such as semiconductor wafer fabrication, where high fluidic purity is a requirement and where the presence of particulate contaminants can lead to product waste or system damage.

The Challenge

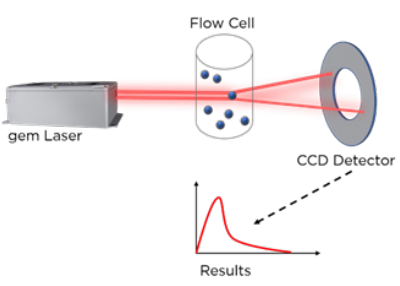
In a semiconductor wafer fabrication process, particle measurement is used to ensure that chemical, cooling and cleaning fluids are free from such contaminants. As industries such as these begin to leverage the power of particle measuring against contamination; size and space of the equipment required to perform this analysis start to become an issue. OEMs and system integrators need ease of integration without incurring costly platform redesigns. Liquid particle measuring is performed by specialist instrumentation that can be integrated into the production line. Such instruments are equipped with high power lasers that deliver a balance of high power and low noise in a compact, high reliability platform.

How Does Particle Measuring Work?

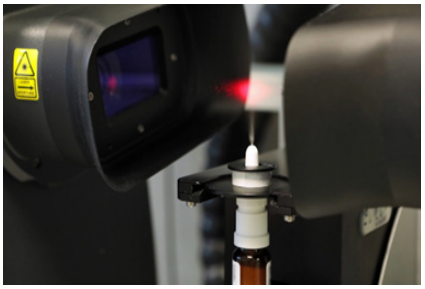
Particulates can be present in a range of sizes and materials. Determining the properties of the contaminant is therefore critical in understanding its presence and possible source of contamination. In order to accurately determine contaminant properties, air-cooled laser solutions are employed. The laser, and either an array detector or CCD camera analyses the diffracted light which then determines the properties of the particles passing between them.

Depending on the required power, a 532 nm gem or opus laser from Laser Quantum is perfectly matched to this application. The laser beam is directed through a flow cell at an angle perpendicular to the liquid flow. The beam is precisely directed through the liquid to a pin hole aperture with beam dump. Any particles that strike the laser beam cause the light to be diffracted away from this beam dump.

Around the beam dump is a CCD or a complex array photodiode; the diffracted light signal from the particle generates a reading that corresponds to the size of the particle and the quantity of particles detected. This process determines the purity of the liquid, leading to an informed decision as to the contamination state of the process. It is therefore critical that these readings are highly accurate, with zero false positives which could otherwise lead to unnecessary waste and downtime for the manufacturer. The Laser Quantum gem and opus lasers are designed to exhibit very high beam quality (M^2 close to 1). In addition, these lasers maintain a highly stable beam pointing accuracy, which provides such



Schematic of how particle measuring works



Photograph showing a system employing particle measuring

systems with a high degree of reliability and consistency in the diffracted light, thus significantly reducing the chances for false positives.

The Solution

Laser Quantum has a long heritage in developing lasers for mission-critical industrial applications following a design philosophy that delivers very high performance and reliability over the longest lifetimes. Designed with the system builder in mind, Laser Quantum has developed a series of lasers specifically to address the requirements of this specialist application. Using patented high performance cavity technology, the gem 532 nm and opus 532 nm lasers maintain constant low noise over long periods of time - one of the key characteristics in maintaining very low false positives within the particle measurement process.

Ease of integration is a key design feature across all Laser Quantum products. Both gem and opus families feature a small form factor and high wall plug electrical efficiency, delivering distinct benefits in thermal management, enhanced by an advanced air cooling system enabling the lasers to be used in environments where water cooling is not permitted or feasible.

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 them truly the laser of choice for high reliability, 24/7 system integrated applications.

The gem and opus lasers from Laser Quantum

Novanta Benefits

Novanta is uniquely positioned to solve even the most complex challenges for OEMs, system integrators, and end-use customers seeking to advance their manufacturing processes with high precision laser systems. With some of the most well-known brands in the industry and in-country application and service support, Novanta delivers reliable, precise, and durable components and sub-systems.

Our Applications Testing Labs offer application and proof-of-concept testing to OEMs, system integrators, material manufacturers, processors, and end-users of automated machinery. Novanta Application Engineers are laser processing experts, and understand the parameters that will ensure successful, efficient laser processing. Using laser and beam steering equipment from well-known Novanta brands, our Application Engineers will determine the key product parameters and processing know-how to achieve the desired results.

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