



IN-PROCESS WAFER STEP HEIGHT MEASUREMENT

Non-contact and non-destructive optical measuring in the nanometer range

During the grinding process the wafer thickness needs to be controlled in real time. A non-contact, optical measurement technology is the ideal solution to monitor the wafer thickness in-process. Optical technology also enables profiling of chip-on-wafer and MEMS during grinding.

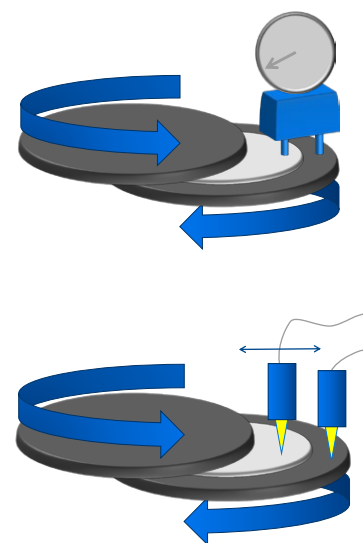
In the semiconductor industry physical wafer thickness has to be monitored in several production steps, such as CMP and mechanical grinding. Optical non-contact measurements based on interferometric technology is superior to contact step height gauges, as described in our white paper "Controlling CMP and Grinding Processes in the Semiconductor Industry"

However, there are still some cases where an interferometric measurement of physical thickness through the wafer is not possible. The infrared light cannot penetrate the surface of highly doped or very rough wafers, thick wafers can even absorb all the light.

Up to now, a contact gauge step height measurement was the only available

technology. With this method, the step height between the chuck table and the top of the wafer is measured mechanically. It is, however, a method with some major drawbacks. The contact gauges touch the wafer and may stress or even damage its surface. These gauges are not maintenance free since the pins have to be replaced regularly due to wear and tear. As the mechanical probes are also temperature-sensitive, a stable cooling has to be applied during the process to maintain their measuring accuracy.

Touching the wafer during a MEMS or chip-on-wafer application is not feasible either. For all these reasons, non-contact and non-destructive optical gauge technology opens up new application opportunities.



Comparison of touch probes and non-contact optical measuring

PRECITEC OPTRONIK'S TECHNOLOGY

Our CHRcodile 2 DPS chromatic confocal sensor offers two independent measurement channels. The sensor can handle two chromatic probes and synchronizes the measurement values and outputs in real time to deliver the step height or thickness of the wafer.

Building on the expertise gained from our interferometric in-process probes, we developed a new stainless-steel water-resistant chromatic probe to enable non-contact step height measurements in a harsh environment.

The optical design enables measurements on different surfaces such as a very diffusive and porous chuck table or the shiny top of the wafer. The new probe also includes a water purge function that prevents grinding particles from negatively affecting the measurement.

The CHRcodile 2 DPS sensor houses a VIS light source and a spectrometer. The optical probe splits VIS light into its spectral components and focuses it through a lens. Depending on the height of the reflecting surface, only one color is reflected back into the lens. The CHRcodile 2 DPS sensor analyzes the reflected light and computes the corresponding distance values at nanometer resolution. This allows the tiniest nanometer-range changes to be clearly differentiated.

Using two optical probes enable measuring the step height between the wafer's top surface and the chuck table and therefore the wafer thickness. This is the solution of choice for difficult-to-measure wafers. An innovative algorithm featuring quantile filters for measurements on rough surfaces ensures stable and accurate measurement results. The Precitec wafer step-height measuring technology is internationally patented*.

HOW YOU BENEFIT

- ▶ Non-contact measurement of wafer thickness in harsh industrial environments
- ▶ Data acquisition rate of up to 10 kHz per channel
- ▶ Cost-efficient solution: replaces and combines two individual sensors
- ▶ Knowhow from more than ten years of interferometric measurements in CMP and grinding
- ▶ Development of chromatic probes for harsh industrial environments

* Patent US9500471B2 and corresponding international patents

PRODUCT PORTFOLIO

The CHRcodile 2 DPS chromatic confocal sensor is equipped with two independent channels that enable simultaneous evaluations at the full measurement rate.



CHRcodile 2 DPS

An embedded processor in the CHRcodile controller uses signals from the individual channels, synchronizes the data, and gives out directly the result of thickness or step height measurements. That is why the CHRcodile 2 DPS is the ideal fit for two-sided thickness measurements of non-transparent materials or layers where the thickness exceeds the measuring range of a single probe.

Furthermore, step height and multi-layer thickness measurements are also feasible. Finally, the embedded processor enables the CHR controller to carry out automatic referencing with no extra hardware needed for thickness or step height measurements.



CHRromatic Probe with water and air purge that measures in process

PARTNERING WITH YOU

Precitec Optronik GmbH is a German manufacturer of highly innovative sensors and optical probes. Our CHRcodile® product line sets the standard in contact-free thickness and distance measurements. Precitec products deliver ultra-fast high-precision measurements for in-process, in-line and off-line applications with measuring ranges from micrometers to centimeters.