



IN-PROCESS WAFER STEP HEIGHT MEASUREMENT

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

Grinding requires wafer thickness to be controlled during material treatment. Optical measurement technology is the ideal solution for in-process monitoring of the wafer thickness without stressing or destroying the workpiece during the measurement. Optical technology also enables profiling of chip-on-wafer and MEMS during grinding.

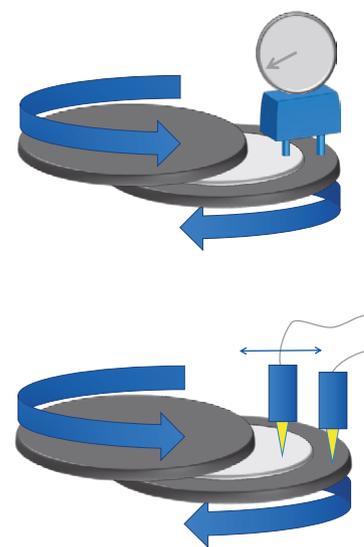
In the semiconductor industry physical wafer thickness has to be monitored in several production steps, such as CMP and mechanical grinding. Optical non-contact measurements based on interferometric technology is preferable to contact step height gauges, as described in our white paper “Controlling CMP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

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

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

In this method the step height between 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 the surface. The gauges are not maintenance free because the pins have to be replaced due to wear and tear. As the mechanical probes are also temperature-sensitive, they have to be cooled during the process. And the temperature of the touch probes has to be kept very stable in order to maintain their 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 in real time the measurement values and outputs to deliver the final 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 measurement in a harsh environment.

The optical design enables measurements on different surface 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 DPS sensor houses a VIS light source and a spectrometer to analyze light. The probe splits VIS light into its spectral components and focuses through a lens. Depending on the height of the reflecting surface, only one color is reflected back into the lens. The CHRcodile 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.

HOW YOU BENEFIT

- ▶ Development of chromatic probes for a harsh environment enabled through know-how from over ten years of interferometric measurements in CMP and grinding
- ▶ Non-contact measurement of wafer thickness in harsh industrial environments
- ▶ Data acquisition rate of up to 10 kHz for each probe
- ▶ Cost-efficient solution: replaces and combines two individual sensors

PRODUCT PORTFOLIO

The CHRcodile 2 DPS chromatic confocal sensor is equipped with two independent channels that enable simultaneous evaluations from both channels 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 measurement 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. In addition, the embedded processor enables the CHR controller to carry out automatic referencing with no extra hardware needed for thickness or step height measurements.



CHRomatic Probe with water and air purge for in-process measurements

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 in process, inline and offline measurements with the highest precision and ultra-fast measuring speeds on all materials and measurement ranges from micro- to centimeters.