Round, compact, light and good value!

No, this is not an article about pencils, ballpoint pens or kitchen rolls! Instead, Dr Jochen Schulze discusses optical probes, Precitec Optronik having successfully been established in non-tactile thickness metrology for the glass container industry for many years. The technology is also suitable for the measurement of other glass types.

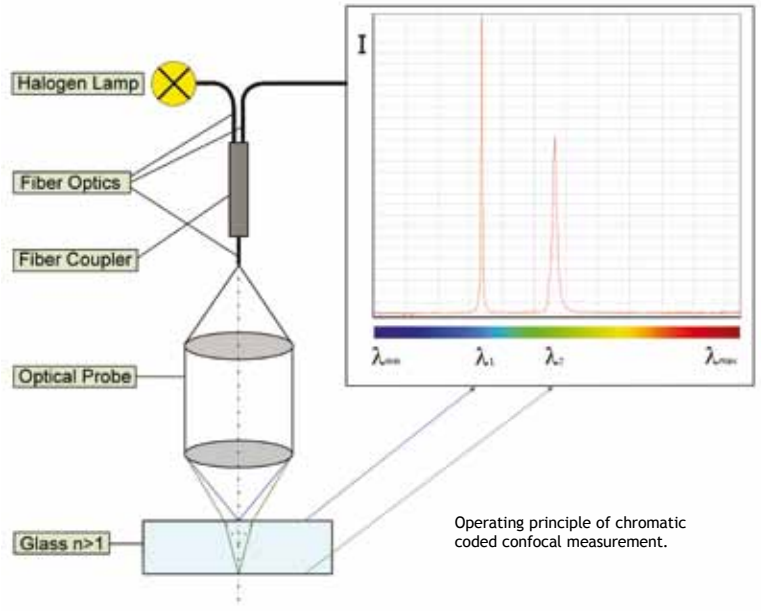
Recently introduced by Precitec Optronik GmbH is a series of compact, round measuring probes, developed especially for CHRocodile M4-Controllers. With housings made from stainless steel, these probes feature measuring ranges of 8mm and 12mm respectively. In comparison to conventional flat probes, they offer substantial advantages in harsh production environments.

MEASUREMENT PRINCIPLE

The chromatic confocal measuring technique has been successfully implemented in the inline thickness metrology of glass containers for some time. White light is fed in an optical fibre and led to the measuring head. This optical probe comprises a lens with a known chromatic aberration, focussing the light onto the glass surface to be investigated, in relation to the wavelength. The reflected light is analysed by a spectrometer which, in turn, calculates the wall thickness of the glass container, as well the distance to its surface.

This approach avoids the disadvantages of capacitive and tactile measurement techniques, eg faulty measurements due to uneven surfaces or relief mouldings. Furthermore, damage to the specimen cannot occur. Given this, it is unsurprising that the chromatic confocal thickness metrology based on CHRocodile sensors outperforms other techniques, its robustness being unsurpassed.

Designed specifically for applications in the glass industry, these probes take advantage of the operating principle outlined above. They complement existing probes with measuring ranges of 6mm, 10mm and 25mm by those with a range of 8mm and 12mm respectively. The modular setup of the CHRocodile M4-controller allows for up to four independent measuring points, permitting an optimal configuration, tailored to the task under investigation. The compact probes have no electronic or moving parts, thereby allowing their integration into demanding inspection environments, as is the case with hot glass containers for example. >



Operating principle of chromatic coded confocal measurement.

CHRocodile M4-Controller with stainless steel probes.

Wavy effects on hot glass containers do not influence measurement accuracy.

	PROBE 8MM	PROBE 12MM
Measuring range	8mm	12mm
Working distance	36mm	54mm
Resolution in z	250nm	360nm
Measurement angle to surface	+/- 15°	+/- 15°
Glass thickness min/max	250µm / 18mm	400µm / 18mm
Dimensions	Length: 44.6mm Diameter: 25mm	Length: 61.1mm Diameter: 36mm
Weight	97g	281g

Compared to earlier flat probes, the constant high numeric aperture in all spatial directions guarantees precise measurements in the case of tilts of the surface under investigation of up to 15°.

IMPROVED PERFORMANCE

Precitec Optronik has co-operated with leading hollow glass manufacturers for many years, constantly searching for product improvements. As a consequence, the performance of the latest probes has been improved, while providing lower prices for the customer.

Based on stainless steel, the design guarantees a long lifetime, as well as high measuring accuracy over many production cycles. The probes are very light, meaning that the requirements on the mechanical stability of the complete setup are substantially less demanding than before.

The compact construction is the result of an advanced optical design, allowing easy incorporation within an inspection environment that could not be realised previously due to space restrictions. Furthermore, due to their small housing, the probes can be protected against the influence of heat, as is the case at the hot end of glass container production.

PERFECT COMBINATION

The latest probes complement perfectly the type CHRododile M4 controller, having been installed a couple of hundred times to the full satisfaction of customers. The compact setup enables the combination of several probes, which scan the object at different positions, each module thereby delivering 4000 times/second the distance to the inner and outer wall of the container, glass thickness, as well as the distance to the object.

Since the measuring spot has a diameter of only a couple of 10 micrometers, even the smallest flaws are detected. At a speed of 4m/second, an updated, independent value for distance and thickness is received every second per probe. In the case of rotational symmetrical samples, in addition to wall thickness, shape and roundness will be detected.

Hot ambient air often causes wavy effects as a result of density fluctuations which, in turn, may cause major measurement errors with other optical methods, including laser triangulation. The chromatic sensor with its high numerical aperture, however, behaves robustly in this situation; the streaking effect is negligible.

Another outstanding feature of the CHRocodile M4 controller is its high dynamic range, whereby measurements on dark glass materials (including wine and beer bottles, dark sun glasses and almost opaque flasks etc) are easy to perform.

In combination with one of the 8mm or 12mm measuring heads, the proven CHRocodile M4 controller represents ideal measuring technology for such tasks as:

- Measurement of wall thickness and shape (in the case of rotational symmetrical objects), even when relief mouldings and other structures exist.
- Determination of eccentricity and orbital errors.
- Thickness and planar deviation on flat glass.

Once again, emphasis should be placed on the fact that the colour of glass to be measured does not have a negative influence on the accuracy of wall thickness measurement, ie the data is independent of colour. ■

Size comparison of the latest stainless steel compact probes versus established probes with a 10mm and 25mm measuring range.

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