

Contactless 3D measurement with latest multi-point sensors

Heye International's Mark Ziegler and Gerd Schütz discuss the importance of wall thickness measurement in the high speed manufacture of lightweight glass containers and the use of Chromocile chromatic confocal sensors from Precitec Optronik GmbH in Heye cold end inspection machines.

Bottles breaking during filling should be avoided at all costs. For this reason, the wall thickness of every bottle should be carefully checked during the glassmaking process. Modern filling machines operate at high speeds, making them more susceptible to an individual bottle having lower breakage resistance. Moreover, wall thickness - particularly for non-returnable containers - is also constantly driven down to save weight and associated energy and materials costs, while at the same time increasing convenience for the consumer.

Heye International offers a comprehensive range of hot and cold end equipment and was responsible for developing the NNPB process for the manufacture of lightweight glassware during the 1970s. Now in widespread use throughout the industry, this technology allows the controlled production of glass containers with minimal wall thicknesses.

Wall thickness is one of many important parameters monitored constantly by fully automatic inspection equipment at the cold end when manufacturing lightweight glass containers. Complex star wheel or stop-and-rotate inspection machines employ an indexed star wheel, with pockets into which the containers fit; during each pause in position, various checks are performed. The wall thickness of every item is inspected by chromatic confocal sensors. Checking that the wall is not too thin at any point requires measurements at a number of positions on the bottle, where the wall is most likely to fall below acceptable limits. Experience shows that this will be on the shoulder or heel of the bottle.

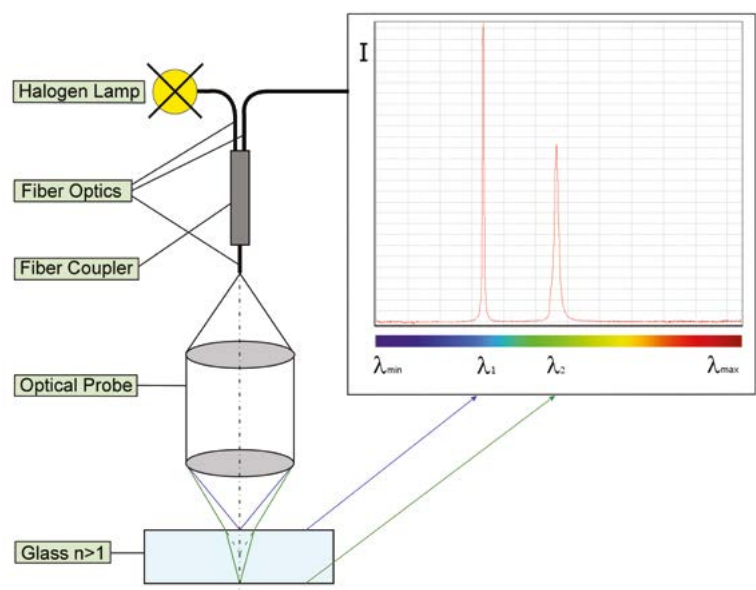
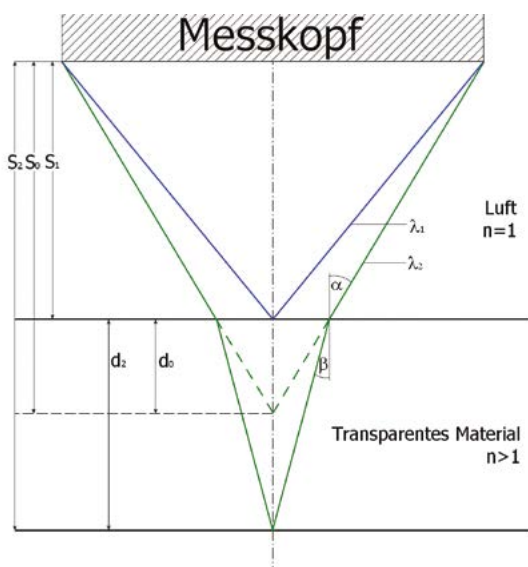


Heye International's SmartLine series of cold end inspection equipment employs the benefits of the contactless chromatic confocal measuring technique.

CONTACTLESS MEASUREMENT

Chromatic measurement has become the standard technique for use in inspection machines but while it operates entirely without moving parts, it must also be able to work with low signal intensity due to the measurement process used. For this

reason, the Chromocile chromatic confocal sensors sourced by Heye International from Precitec Optronik GmbH of Neu-Isenburg, employ complex signal analysis technologies, whose particular strength becomes apparent on highly scattering or semi-transparent (coloured) surfaces



In the chromatic confocal measurement principle, the container 'boundary' - either the outer or inner surface of the glass - has one wavelength focused precisely on it. This wavelength is reflected, allowing the sensor to determine the thickness of the glass from the resulting peaks (image: Precitec Optronik).



Multi-point measurement system with chromatic confocal sensor for measuring the wall thickness of glass containers. A single-point sensor is shown in the background in the right-hand image (images: Heye International).



that defeat other 3D measurement processes.

A major advantage of this technology is its suitability for contactless in-line measurement of container glass, the bottles being axially rotated in the star wheel pocket while the glass thickness is captured using compact chromatic measuring heads. So fast is the bottle rotation in this process that visual assessment of surfaces is no longer feasible.

Wall thickness measurement is unaffected by the rotation or movement of bottles on the turntable. The decisive factor in the use of this technology is that high precision wall thickness measurement is not dependent on the measured object being static or held in an exact position. A further advantage is that, unlike other

contactless measurement processes, thin wall thicknesses can be measured over a large measurement range. In addition, this process can handle greater separations and angles between the measuring heads and glass surface. Potentially, the measurement technology employed in Chrocodile sensors can achieve even higher speeds; the upper limit is set by the container output and transfer mechanisms related to the star wheels.

The modular construction of Heye International inspection machines allows further testing/checking equipment or sensors to be retrofitted at a later date. Crack testing is always performed, generally followed by wall thickness checking. The ovality of the bottle body is a further criterion, together with the outer neck diameter, a key factor in ensuring proper sealing of the bottle.

Set-up and adjustment of the inspection machines is performed using appropriate reference bottles. Regular sampling for the laboratory serves to check the internal pressure and to ensure that the whole process is under control.

MULTI-POINT SENSORS

The latest filling techniques bring with them increased demands on the quality of glass containers. Quality assurance also has a part to play, with major advances continuing to be made in the measurement technology employed in inspection machines.

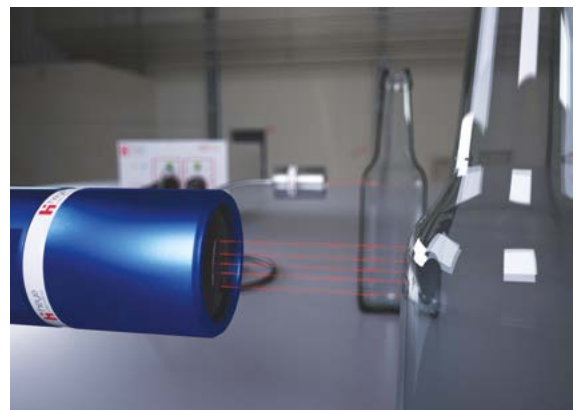
At glasstec 2014 exhibition, Heye International presented its latest generation of sensors, which for the first time do not use only single points to determine glass thickness but can measure container

wall thickness along a line. This is achieved by arranging several measuring points along a 10mm line, enabling the area to be checked for thin spots to be increased by a factor of ten, without extending the time needed for measurement. This considerably increases the equipment's ability to detect thin spots on the surface of the bottle (in locations whose precise location cannot be predicted to within a millimeter).

The sensors downstream of the special measuring heads support up to 12 individual points that can be measured in parallel. This sensor technology can again be retrofitted to existing star wheel machines. This allows the benefits of the contactless chromatic confocal measuring technique to be extended into other areas of application. Together with the additional container properties testing provided by Heye's SmartLine product range, which can comprise up to six inspection units, this technology becomes an essential prerequisite for ensuring that glass producers are able to meet the ever-increasing demands imposed by bottlers. ■



The indexed star wheel of an inspection machine receives articles from a conveyor and performs a rotate-and-stop cycle. Each time the wheel stops, static measuring heads perform one of a number of tests, checking parameters such as wall thickness (image: Heye International).



A multi-point sensor simultaneously measuring the container's wall thickness at five points. The measurement points are arranged along a line 1cm in length (image: Heye International).

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