

3D dip and saddle measurement innovation

In January 2017, Tiama launched its WEM, Wire-Edge Measurement device, an innovation that provides the ability to measure container finish inner protrusions down to μm glass. Continuing along the same path, the company has now brought 3D characterisation to the finish surface. Jean-Vincent Jinot describes this DSM inspection device, where DSM is an acronym for dip and saddle measurement.

Dip and saddle measurement inspection, DSM, is an optical device that performs a 3D mapping of the container ring surface. The equipment is capable of mapping all round article finish surfaces and is effective for jars up to 110mm diameters. The DSM uses this mapping to assess a container's finish quality and establish the following measurements:

- Dip measurement: Lack of material on the finish surface.
- Ovality measurement: Out-of-roundness of the ring diameter.
- Saddle measurement: Double and symmetrical; distortion of the finish surface.
- Off-level measurement: Slope on the finish surface.

The use of a highly defined camera embedding more than four million pixels and the selection of optical devices produced by partners involved in the space industry, bring finish surface inspection to a level never previously reached and authorise the image resolution to be better than $5\mu\text{m}$. To protect such a breakthrough technology, Tiama has filed patent applications covering the WEM and DSM solutions.

Precise 3D mapping

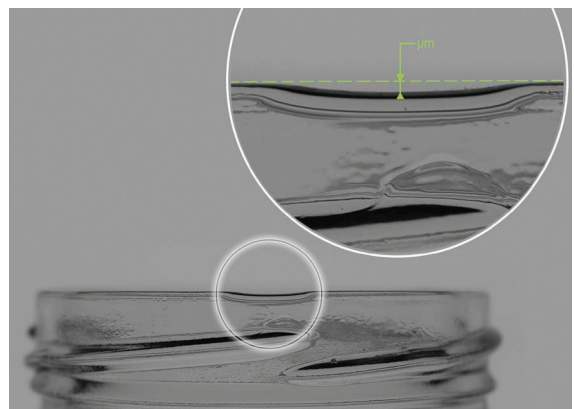
The challenge of such innovative inspection was to obtain high precision 3D mapping of the ring surface with non-contact and non-rotating inspection, capable of reaching ring tolerances as stringent as the jar finish, with its tolerances between $50\mu\text{m}$ and $150\mu\text{m}$. Existing inspections combining several 2D views with matrix cameras were not found to be precise enough to guarantee good repeatability of measurements, despite the high production cost of such solutions. Furthermore, such a system was unable to correctly assess the off-level measurement of the finish.

The search for the most adequate solution and for partners that would allow the highest optical performance kept Tiama with no solution for a long

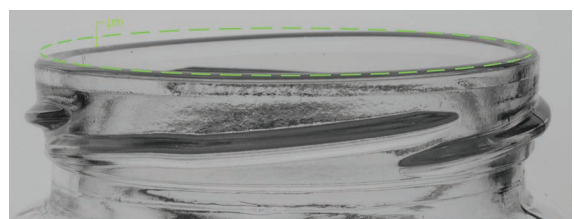
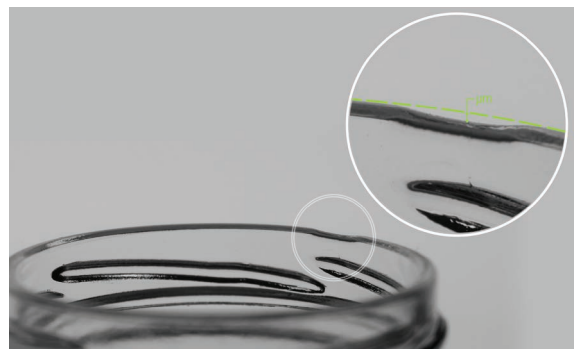
period. By continuing to innovate and thinking 'out the box' brought Tiama to evaluate how the highest quality of optics could help in the glass industry. By successfully using high end optics associated with its latest high definition camera and treating the generated images with its innovative electronics, Tiama maintained its innovation level as the highest in the industry.

The DSM that maps the surface generates for each container more than 4700 measurement points in x, y and z and expresses these values in μm . This is a breakthrough. However, a system may be the best ever; its acceptance to final users is very much linked to the quality of its set-up interface, its ergonomics and user-friendliness.

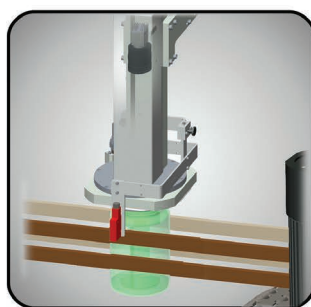
A key asset of this inspection is to be able to inspect a broad type of containers, whether narrow neck containers or jars, with exactly the same settings and just a few minutes to initiate the measurement. As an inspection device of the famous Multi4, the DSM shares its powerful latest generation electronics, providing the highest speed analysis. With the DSM, the Multi4 is now capable to inspect on-line all types of container finish for dip, saddle, ovalisation and off-level with such precision and repeatability that it eliminates false rejects. This way, no choice has to be made between quality and productivity.



Above and below: Dip defect measurement.

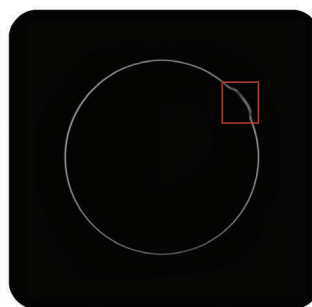


Saddle defect measurement.



DSM operating principle

The DSM feature in the Multi4 equipment.



DIP defect measurement



SADDLE defect measurement

An additional tool for the Smart Factory

The container finish area is one of the most sensitive to process deviation. Gob weight, glass temperature, pressures, all the process parameters generated ahead of the forming process, if not fully controlled, may result in finish dimensional defects. For years, glass container manufacturers have called for process control, aimed at reducing defect rates and improving the global efficiency of their investments. One mandatory element to put the process under control is to observe the process correctly.

The Tiama Innovation Team is developing hot end process control sensors with this strong objective. In the cold end glass process, the company's approach is to go from sorting defective containers towards generating data to characterise the containers. Indeed, this data will guarantee the quality of production by sorting the defective containers and more. The WEM and now the DSM are both cold end inspection devices that feed the smart factory with this valuable food: Data.

Collectively, Tiama has succeeded

in delivering an accurate measurement tool at the cold end to serve the smart glass container factory. The company is currently leading several advanced projects, aimed at making use of the massive data gathered throughout the plant process. It opens another door for the glass industry and brings the Smart Factory concept closer to reality.

Considering its cold end inspection machines, laboratory equipment and hot end process controls, Tiama is now able to gather for each container hundreds of unitary values, whether it is in micron, in millimeter, in °C, in heat emission, in seconds. This data allows the company to fully identify and characterise each container. The Tiama Traceability product line, which enables glass container manufacturers to engrave each container with an individual time stamp and its original cavity, even guarantees the consistency of all this data from the gob to the packed ware. It is a gold mine that data scientists look at with envy. With the Smart Factory, Tiama has reached the point where each piece of data is valued and delivers global efficiency improvements. ●



Multi4 base finish and camera mould code reading.

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