# Refractory Thickness Sensor Expands its Scope

Yakup Bayram* discusses Smartmelter and how it has become a standard part of regular furnace health monitoring programmes.

When PaneraTech first released SmartMelter technology to the public in 2017, it was a validated solution for assessing the thickness of furnace refractory sidewalls and bottoms. The glass industry responded with excitement, finding areas of application across the full cycle of asset management and expanding the scope of materials that can be monitored. In some cases, it even influenced the development of new variations of the patented sensors.

SmartMelter is a furnace life optimisation solution that provides deterministic data using advanced radar technology. PaneraTech first partnered with Libbey glass to address speculation when assessing the condition of furnace below the glass level. Although decades of research had been invested into solving the problem, no one had found a solution that provided precise information. PaneraTech used its experience with advanced radar technology to develop sensors that could successfully identify the exact location of glass penetration and measure the remaining thickness of the refractory block.

At the time, the glass industry had grown doubtful that a solution could be developed, and therefore had not begun to imagine the full scope of applications that such a technology could provide.

Today, SmartMelter offers a complete monitoring programme facilitated by a system of patented sensors and proprietary software. The SmartMelter team first maps the entire furnace into sections that can be identified in XSight software for data collection and visualisation of the furnace. XSight also keeps comprehensive furnace health records. Early stage glass penetration is identified using the Furnace Tomography Sensor (FTS), which interacts with the insulation layers from the outside of the insulation wall. Residual refractory thickness is measured using the Refractory Thickness Sensor (RTS), which records the interface between the glass and the refractory wall from the outside of the refractory block. All of the data is reviewed for quality control, analysed, and presented to customers in XSight along with recommendations.

## Validation on Sidewalls and Bottom

SmartMelter technology was first validated in a blind trial on the sidewalls of a container glass furnace that was scheduled to be drained for cold repair. Before the furnace was drained, measurements were taken in 11 spots on the furnace on both sidewalls, a doghouse, and the area between the throats. The original blocks were recovered after the

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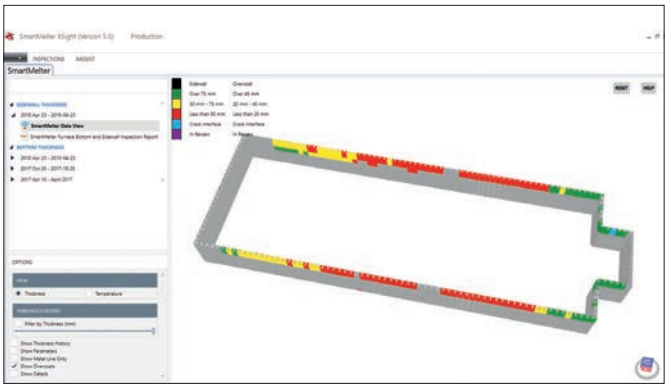

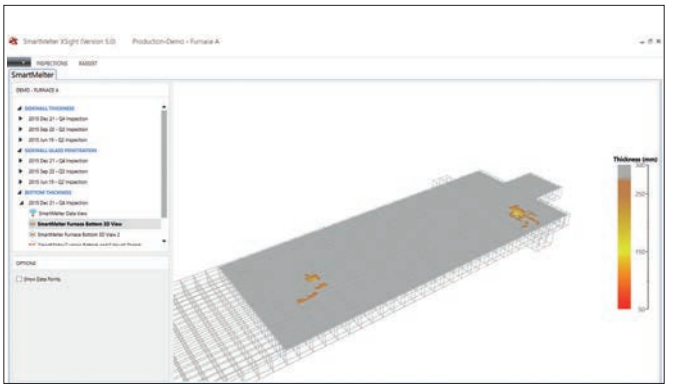

drain and measurements were compared. The actual block was found to be within 4mm of SmartMelter's measurements.

One of the first companies to approach PaneraTech for an alternative use of the technology was a float glass manufacturer that wanted to monitor the condition of a furnace bottom.

PaneraTech worked with the company to develop a sensor that would accurately measure the furnace bottom and was sized right for data collection.

SmartMelter was used to closely monitor the furnace bottom during its last several months of operation. Just before the furnace was drained for rebuilding, the SmartMelter measurements were recorded for a blind trial.

After the drain, the furnace bottom was measured, validating the SmartMelter measurements within 5mm.

## Expanding capabilities

The successful use of SmartMelter to detect glass on furnace bottoms led to the testing and use of the technology to identify metal infiltration on the bottom of furnaces that use recycled glass.

XSight software is now able to display extensive 3-D imaging of furnace bottoms showing the location and extent of wear for both glass and metal.

After SmartMelter technology was used successfully on fused-cast AZS, specialty glass manufacturers started to request the technology for high zirconia. Using PaneraTech's careful three-step method of internal validation, field testing, and blind trial, a SmartMelter programme for high zirconia was developed. There is now a high demand for SmartMelter monitoring programmes in the specialty glass industry, where furnaces carry a higher cost and shorter lifespan.

In addition to this diversification of materials that can be monitored, SmartMelter customers have expanded the purpose and use of the technology to inform decision making across the life cycle of their furnaces.

The most common use of the technology is to monitor a furnace that is at a critical stage. This is the stage that usually produces the most tension between optimising furnace life and mitigating risk, and accurate data reduces this tension, often allowing the furnace to operate longer.

However, manufacturers also use SmartMelter to create repair schedules and improve budget planning. Data can be used to evaluate cooling techniques, target specific areas, or identify exactly how far a glass line should be lowered for hot repair.

Once customers start using SmartMelter, they often find ways to make informed decisions earlier in the furnace lifecycle. For example, some customers have used SmartMelter to determine the best product mix for their furnace.

Some have identified batching problems early enough to make adjustments.

Problems can also occur with a refractory when the furnace is first heated if expansion joints don't close well and glass leaks through the joints into the insulation. A baseline inspection after heat-up can prevent a surprise leak in the early years of operation.

SmartMelter monitoring has been welcomed and adapted rapidly within the glass industry to meet needs and improve operations.

The programme has become a standard part of regular furnace health monitoring programmes, affecting decisions at all stages of furnace life. ■

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