

Safer cullet use: Detecting metal infiltration in furnace bottoms

Dr Yakup Bayram discusses the successful application of advanced radar technology to detect and map metal infiltration in furnace bottoms.

Manufacturers are already finding broader applications for SmartMelter, an advanced radar technology that measures refractory thickness and detects glass infiltration into furnace walls. The technology became available to the public earlier this year, coinciding with a successful validation trial on a furnace bottom. This caught the attention of a glass container manufacturer who was looking for a way to mitigate the risk of metal infiltration due to cullet use. The company contacted PaneraTech, developer of SmartMelter, to test the sensors' ability to detect and map metal infiltration in furnace bottoms.

SmartMelter was originally developed to solve the problem of managing furnace health, without clear data on the condition of furnace walls. Before this technology was introduced, glass could begin to leak into the furnace insulation layers undetected. Although speculative methods were available for assessing the wall conditions, the exact location or extent of infiltration could not be determined with certainty. Risk management required heavy guesswork, which often led to a conservative maintenance schedule that reduced overall operating efficiency.



SmartMelter sensor to map metal infiltration in a furnace bottom.

ELIMINATE THE GUESSWORK

SmartMelter is the result of over a decade of research and development to improve furnace inspection methods and eliminate this guesswork. Radar technology is used to inspect the interior condition of furnace walls. The data is then visualised on proprietary software that also serves as a record-keeping hub. All of this is done using two non-invasive sensors that can be used without halting furnace production. The Refractory Thickness Sensor (RTS) measures the residual thickness of the refractory, while the Furnace Tomography Sensor (FTS) maps the exact location and severity of glass infiltration.

After successfully validating this technology on sidewalls, the SmartMelter team was contacted to test the sensors on a furnace bottom in the last year of its campaign. SmartMelter took an initial assessment and then monitored the progress of glass infiltration into the furnace bottom for eight months. A validation trial was performed just before the furnace was drained for its scheduled rebuild. The trial confirmed accuracy of glass identification and residual thickness measurements within 0mm-5mm. The team could now confirm its ability to monitor both sidewalls and bottom of a furnace to manage risk.

This was exciting news for a glass container manufacturer using cullet in its production. The use of recycled glass can magnify operating risk, as metal pieces are often stuck to the cullet. Eventually, these metal pieces float to the bottom of the furnace and begin to drill into its bottom. This creates channels for the glass and increases the speed of penetration into the bottom layers of the furnace. A catastrophic production disruption can happen if this risk is not monitored carefully.

SUCCESSFUL DEMONSTRATION

After reviewing the results of SmartMelter's validation trial on a furnace bottom, the manufacturer asked the SmartMelter team to demonstrate its ability to detect not just glass but also metal infiltration in a multi-layer furnace bottom. The team was happy to explore this expanded use of its technology. SmartMelter was used on multiple furnaces at the manufacturer's facility to produce 3D mapping of infiltration, including the metal pieces.

This successful demonstration opens further opportunities for glass manufacturers who use cullet in their production. The insight provided by mapping of metal infiltration carries a high value. While SmartMelter cannot reduce the speed of accelerated erosion caused by this method, it significantly improves risk management. Glass manufacturers can now monitor the exact areas of metal infiltration on a regular basis and make informed maintenance decisions. Using deterministic data about the level of metal infiltration that has occurred, maintenance can be delayed until it is clearly necessary and performed

only when needed. This creates gains in productivity and efficiency as the campaign life of the furnace is extended.

PaneraTech welcomes opportunities to partner with manufacturers who want to customise and expand the use of SmartMelter to meet their needs. Industry partners played a key role in the development of this technology and the company expects this kind of collaboration to continue. PaneraTech has recently expanded its SmartMelter team to accommodate the growing interest in this solution and maintains a high level of customer interaction. ■

SmartMelter is a registered trademark of PaneraTech Inc.

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