# More data is a game changer

PaneraTech's continuous monitoring sensors for steel will soon be available for glass refractories. But IoT sensors and constant monitoring at critical locations will not replace regular check-ups just yet, explains Fred Aker.

After 10 challenging years of development at PaneraTech to solve the problem of using radar on extremely hot materials, SmartMelter was commercialised in 2017. In the summer of 2020, we eclipsed a half-million measurements. At the end of March 21, we were close to 724,000. By the time this article is published, we should break the one million milestone. What does more data mean for our clients?

Up to 2017, PaneraTech was a radar company. We would tell clients [their] remaining refractory thicknesses and it was up to them to figure out what that means. Now, through so much data including monitoring many furnaces over time, we tell our clients what maintenance actions they need to take and when to take them. Even more importantly, we are telling many clients what actions not to take. This enhanced data capability has been complemented by hiring glass furnace technical experts.

Currently, we send equipment, conduct an inspection, and repeat in six months to a year. We are only collecting data at each furnace block location for a few seconds per year. The future is a combination of full surveys and constant monitoring at critical locations using IoT (Internet of Things) sensors.

## Continuous monitoring

SmartMelter has been successfully employing permanent sensors on furnace throats for over five years with zero failures. The driver at the time was cramped plant designs that allowed no access to the throats following construction. Since corrosion in glass furnace refractory occurs over time, no thought was given to continuous monitoring. This data is picked up periodically in a manual process.

Enter Polaris. We have developed a new generation of continuous monitoring sensors for steel. The application we are piloting has refractory life which is measured in days and weeks and not in years as in glass. Continuous monitoring is the only option in such applications.
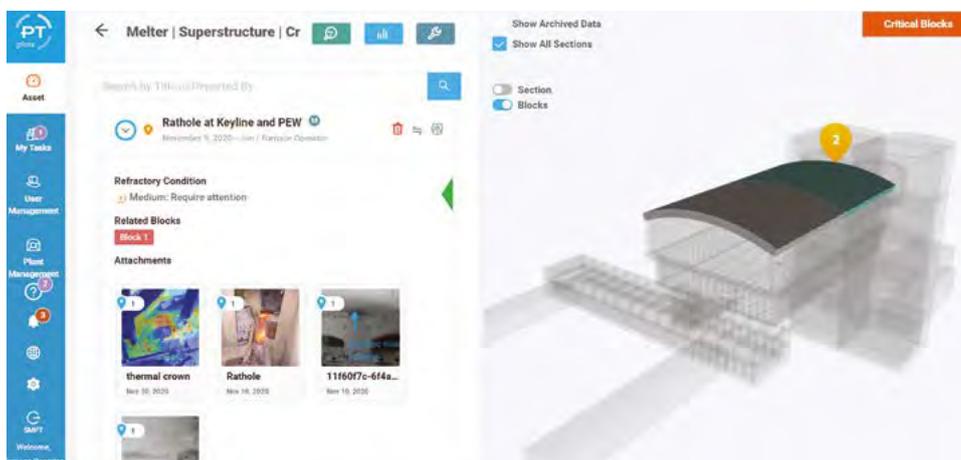
After this pilot is finished, we are going to move these new Polaris sensors into glass.


First generation permanent sensors.

## Polaris advantages include:
- Lower cost sensors. Previously we were using our normal sensors for permanent installation tying them up for years at a time.
- Ability to install Polaris sensors in difficult to access areas during construction.
- Ability to continuously monitor high wear areas such as doghouse corners and throats.
- Production flexibility. As furnaces go hybrid or even full electric, there will be more electrodes to work around. For safety reasons, our portable sensors require short windows of turning off boost when collecting data adjacent to electrodes. While we work closely with plants, this can impact production. Polaris sensors can be placed permanently in these areas.
- Timing flexibility. We can install these sensors at construction for suspected high wear areas. These sensors can then be removed to overcoat and be placed back on the new materials. These sensors can also be installed on the fly if a hot spot is discovered or if a regular SmartMelter inspection detects a problem.
- Temperature flexibility. These new sensors will withstand constant temperatures of 1100°C. Measurements will no longer be limited to surface temperatures of 500°C.
- Material flexibility. Through getting more data, we hope to see through more materials including chrome overcoats. We already have good visibility on SEFPRO wool products and are working with major refractory suppliers to develop SmartMelter friendly patch materials.
- Deeper range. Having more data will allow us to see deeper and through additional materials where the data from our two second snapshot is marginal. Both into AZS materials and also through more insulation layers on the bottom. Even though our current sensor range allows us to see two years into the future on bottoms, clients are asking for more.

All of this adds up to situational flexibility. Currently we are looking for ideal conditions as we have two seconds to get our snapshot. In the future, instead of visiting clients annually, we will be touching them daily.


Screenshot from SmartMelter XSight Refractory Platform.

## Enhancing regular inspections

What does more data offer? In other fields, constant data from cheap sensors are delivering amazing insights. Recently it has been determined that Fitbit watches sense and can track the effects of Long Covid.[1] This is done by comparing sleep and heart rate data before and after an infection. If Fitbit only had our current two-second window to collect data, it could never detect these effects.

Our mission is to stop abusive operating practices before they result in accelerated refractory wear or even worse, glass leaks.

So, will Polaris IoT sensors and continuous monitoring replace regular SmartMelter check-ups? The answer is no. These sensors will be in locations that make sense but cannot be everywhere on a furnace. Polaris will enhance regular SmartMelter inspections, not replace them.

Polaris sensors will be introduced to glass manufacturers at the end of 2021 as a subscription service with PaneraTech's data analytics engine analysing the data.

## SmartMelter product roadmap

Many companies are choosing to use SmartMelter in the last third of a furnace campaign, especially when it comes to risk management and looking at lower sidewall insulation and furnace bottoms. PaneraTech has developed SmartAudit, aimed at mid-life furnaces to reach more furnaces in the second third of their life. This SmartAudit will enhance a current annual visual audit with limited SmartMelter data. During an annual audit, SmartMelter data will be collected at two points on each sidewall. This is not designed to find specific issues; this will give a general indication of how the furnace is performing against predicted wear. If there is a wide variance (positive or negative), then we will want to investigate why this is so. In addition, we will let SmartAudit clients take an additional 10 measurements in insulation areas that they choose. SmartAudits will be available through PaneraTech directly or through our partners.

Development continues on our SmartMelter XSight Refractory Platform. This is already being used to deliver all SmartMelter reports. For customers subscribing to the platform, they can use this to track all observations including visual, thermal, radar and endoscopic. By entering observations in a standard format, this will allow for later machine learning. Currently clients store data in different silos in different formats which do not allow the use of machine learning.

XSight platform's current machine learning capabilities are already being tested with major steel manufacturers in the US and we hope to make this capability widely available to the glass industry soon.

While a subject for another article, next year we will be enhancing superstructure audits. PaneraTech can be your trusted partner to monitor refractory wear from the regenerators through the forehearths. We call this EFM or Entire Furnace Monitoring. ●

*SmartMelter and SmartAudit are registered trademark of PaneraTech Inc.*

### Reference
1. 'Fitbits Detect Lasting Changes After Covid-19', *New York Times* 7 July , 2021

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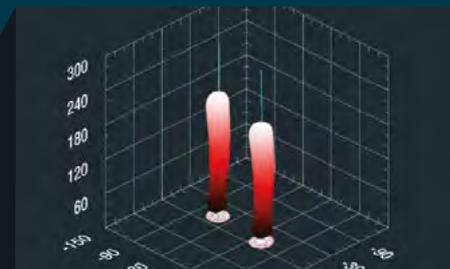
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