

From detecting brain tumours to early stage glass leaks

Pioneering radar-based solutions for furnace inspection, glass leak prevention and overall furnace asset management, PaneraTech was the first company to solve the problem of measuring refractory wall thickness on operational furnaces. It is a leader in modernising furnace inspection and health monitoring processes, as well as introducing substantial glass risk reduction in glass manufacture.

USA-based PaneraTech Inc specialises in the development of radar-based industrial furnace life monitoring and process monitoring solutions. The company's flagship innovation, SmartMelter is an integrated sensor + software package that offers a full furnace inspection solution from visualising actual furnace wall thickness to keeping a record of endoscopic images and all other maintenance-related information.

The origins of this business go back to Ohio State University's ElectroScience Laboratory, the largest university-based electromagnetics research laboratory in the USA. PaneraTech's founders have been involved in radar-based sensor development for over four decades, primarily in advanced defence applications. "We have been solving problems that have never been solved before" explains Dr Yakup Bayram, CEO and Chief Technology Officer. "PaneraTech was founded to address industrial problems, utilising advanced radar-based technologies used in the defence world."

Although the company was established in 2010, its founders have been working on SmartMelter since 2007. Dr Bayram and his colleague Dr Eric Walton set up their operation next to The Ohio State University, where

they had access to facilities to develop their industrial sensor solutions.

Yakup Bayram has a PhD in electrical engineering from The Ohio State University and an MBA from The Ohio State University Fisher College of Business. "When we were introduced to the refractory thickness problem back in 2007, we knew nothing about the glass industry" Dr Bayram recalls. "Tom Dankert (retired Global Furnace Manager at O-I) and Elmer Sperry (Global Furnace Lead at Libbey Glass) were looking for a way to optimise furnace campaign life and lower the risk of glass leaks in furnaces. There was no way to inspect the condition of refractory walls below the glass line. Therefore, the life of each furnace could not be predicted with accuracy. Most maintenance was performed based on a periodic schedule rather than the actual condition of the furnace. Thermal imaging and well kept records improved speculation. However, this did not solve the problem. Many furnaces were being rebuilt and overcoated on a conservative schedule, thus reducing the maximum life one could have out of the furnace. Some leaks still occurred, halting production for several weeks at a time."

According to Dr Bayram, having

benefitted from their mentors' industry knowledge, PaneraTech personnel have been working with glass manufacturers in many different facilities in North America and Europe.

SELF-SUFFICIENCY

Since those early days in Columbus, Ohio, the business has relocated to northern Virginia, becoming fully self-sufficient, with its own infrastructure. Situated close to Washington DC, this area boasts many talented engineers in radar and electronics, allowing PaneraTech to build a world class engineering team.

There are currently eight engineers within the team, which is well known within the radar world, including four PhDs. Chief Scientist and co-founder Eric Walton, for example, is acknowledged for his invention of noise radar, whose presence cannot be detected, finding many applications in the defence industry. Similarly, other PaneraTech PhD engineers have equally diverse backgrounds, ranging from working on the detection of brain tumours (the same problem as finding glass infiltration in insulation or voids in refractories) to advanced radar technologies for through wall imaging used in military operations and wirelessly measuring strain on jet engine blades operating at 1200°C and rotating at several thousand rpms for military aircraft platforms.

"We have also had tremendous experience in through-wall radar imaging that is used by security forces to map the interior layout of buildings before an operation takes place" Yakup Bayram explains. "It is interesting that our Furnace >



The PaneraTech and Vidrala teams for SmartMelter trials: Diego Ochoa Escalona (Vidrala Corporate Furnace Production Manager), Pedro Andrade (Vidrala Plant Batch and Furnace Manager) and Andre Grilo (furnace operator), together with PaneraTech's Yakup Bayram (CEO) and Alex Ruege (Principal Engineer).



The PaneraTech team at the Chantilly offices.



PaneraTech team members Dr Alex Ruege, Justin Knowles, Dr Eric Walton and Dr Yakup Bayram at the Conference on Glass Problems.

Tomography Sensor (FTS) leverages similar techniques used in brain tumour detection to determine the presence of glass infiltration in insulation. Our Refractory Thickness Sensor leverages advanced algorithms to determine whether we are measuring thickness to the glass interface or cracks and voids by leveraging similar applications used in determining whether an aircraft is a foe or friend. In other words, at PaneraTech, we have done so much past work on medical, military applications that directly speak to the heart of the furnace wall erosion and glass leak problem in the glass industry."

And among the individuals to have been a major influence on the company and its development is Jim Armitage, a retired CTO from Northrop Grumman, the world's second largest defence company. Mr Armitage spent his entire career making advanced radars for military applications that today, are flying in F-22 to F-35 fighter jets.

GLASS FOCUS

An important part of the PaneraTech strategy is to engage customers early on and make them part of the product development effort. "In other words, our partners receive tremendous voice in product development and our product roadmap" Dr Bayram confirms.

Today, the company is 90% focused on the SmartMelter solution, initially for use on glass container, tableware and float lines in North America and Europe. Next year, the organisation plans to expand its coverage to the rest of the world via a series of partnerships with major furnace inspection/repair organisations, who will represent the organisation in these markets.

SmartMelter is the most innovative solution offered by PaneraTech to the international glass

community. This comprehensive furnace management solution visualises refractory thickness below the glass level and electronically keeps records of entire furnace inspection and maintenance regimes. "Our global customers particularly enjoy central record keeping and also enabling standardisation of their furnace inspection policies across their global plants" Yakup Bayram suggests. "We help the industry get the maximum out of their furnaces with the lowest glass leak risk. In other words, we optimise the life of multi-million dollar furnaces by providing actual, deterministic health of the furnaces."

PaneraTech is extremely IP-centric and R&D is at the core of the company's activities. "We have all the facilities we need to be able to perform any kind of R&D in radar-based solutions and also closely work with customers, who open up their plants to test and develop our solutions."

Participation at the annual Conference on Glass Problems and regular GlassTrend meetings provides an important platform to interact with customers and expand the company's partner network. In addition, PaneraTech will exhibit at glasstec 2016 exhibition in Düsseldorf this September (Stand No 15E31), where the latest developments in sensor technology and powerful furnace management modules will be showcased.

Libbey Glass has been an extremely valuable and supportive partner in the development of SmartMelter, providing the necessary facilities for development and validation of the technology, as well as actively helping PaneraTech to determine the product roadmap and how to maximise its value proposition to the industry. "I don't think we could have come this far without the support of Libbey" Dr Bayram confirms.

"Libbey has a very forward-looking culture, which has been instrumental in bringing innovation into the industry through partnerships with companies like ours, who were initially outside the industry. What we have discovered is that rather than being conservative, the glass industry is very thorough in considering potential solutions. That is why we have validated the SmartMelter with our global customers in multiple trials. These successful trials have resulted in tremendous support and

more partnership opportunities within the industry."

The support of O-I in the development of this technology since 2007 is also gratefully acknowledged. "They have been extremely helpful in providing funding and offering their furnaces for development and validation" says Yakup Bayram. "The success of this and other customer relationships is based on trust and open communication."

REVOLUTIONARY IMPROVEMENTS

"We take on problems that have never been solved before" says the PaneraTech CEO and Chief Technology Officer, "so what we offer is revolutionary not incremental improvement. Furthermore, we are extremely close to the research community, so we know about the latest solutions to address specific problems. One thing that really differentiates us is that we foster strong and deep relationship with our partners, interactions with customers never being transactional but relationship-based."

Furnace design and construction companies, along with maintenance and inspection firms, are considered natural partners in servicing the glass industry. "Our integrated SmartMelter sensors are a natural fit for the next generation self-sensing smart melters. Similarly, our portable tools are complementary to existing inspection and maintenance companies, as they provide deterministic and more accurate overall health of furnaces and refractory walls."

PaneraTech is also finding the insurance industry to be a major partner in its solution. The fact that SmartMelter greatly reduces glass leaks in furnaces has significant implications for insurance companies.

According to Dr Bayram, SmartMelter is revolutionising the industry and is paving the way for self-sensing smart furnaces. "There will be many other sensors used on both furnaces and the glass manufacturing process in a few years" he contends. "As our customers better understand how radar works, how low cost and practical we can make it, we are presented with so many other problems to be solved at both the hot and cold ends. Given the non-invasive, non-destructive nature of radar-based solutions, we are very excited to continue offering innovative solutions to the industry." ■



O-I, Libbey and PaneraTech personnel at early SmartMelter trials.

FURTHER INFORMATION:

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