

Digital tools for kiln burning

As producers advance to Industry 4.0, it is crucial for operators to have comprehensive, accurate data to make the best decisions for their processes and plants. With advanced digital tools, kiln data is easily captured and interpreted, enabling operators to make timely decisions to optimise kiln processes. Tools like HGH's Kilnscan and Pyroscan utilise scanning features with detailed historical data to produce actionable insights for plant operators to monitor the kiln optimisation process and plan for preventative maintenance.

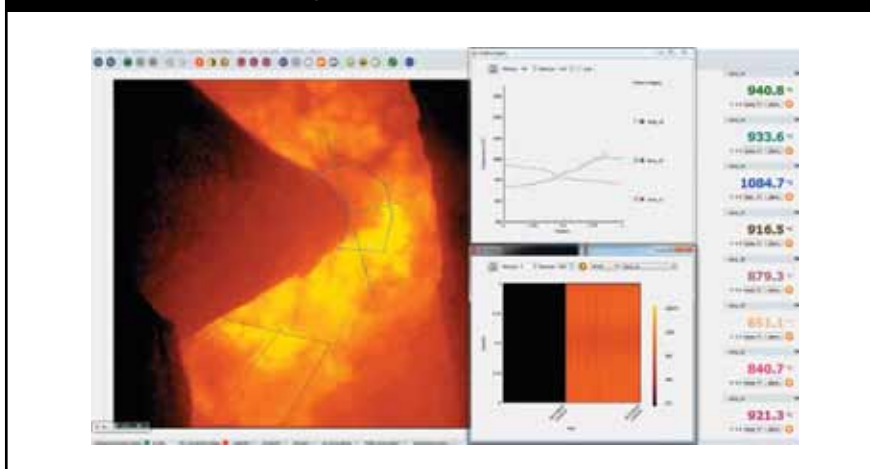
■ by **HGH Infrared Systems, USA**

Monitoring the burner of rotary kilns is not a new challenge for operators, but significant digital advancements have transformed the process. HGH enables operators to optimise the internal burning process of kilns in new ways with full visualisations of flame shape and precise temperature measurements in the clinker area. Pyroscan, HGH's high-performance pyrometric camera, captures high-resolution thermal images inside the kiln, providing high-accuracy temperature measurements of any point in the burning zone. Data from Pyroscan streams live over IP to the operator's remote location, where the Pyroscan software displays the high-resolution images and precise temperature measurements in real time with over 1.2m points shown in the field of view.

With the ability to create user-defined measurement points, Pyroscan provides a large variety of reliable temperature readings that allow users to analyse various aspects of their burning process. Pyroscan's dust filtering system allows Pyroscan to reliably operate in the harshest of environments. This gives operators a clear view of what is going on at any point inside their kiln, providing vital early detection of changes in combustion, clinker fall, or various other kiln shortcomings.

Armed with both Pyroscan's infrared and visual data on the flame front and flame shape, operators can see exactly what is happening in the kiln and make the proper adjustments. This ensures efficient fuel burn by allowing operators to take immediate action to stabilise the burning process, resulting in increased clinker quality and a decreased risk of kiln hotspots. At a time with increasing standards for energy efficiency and sustainability, being able to control the combustion process for

Flame visualisation with custom parameters



various fuel types is a must for modern kiln operators. Thus, it is crucial to have easy-to-use, comprehensive digital tools such as Pyroscan.

Visualising data more effectively

Beyond internal combustion, digital visualisations of the burning process give operators a deeper insight into kiln operations and opportunities for

preventative maintenance. Kilnscan, HGH's adaptive infrared kiln scanner, continually monitors the kiln as it rotates providing key insight on hotspots, coating loss, tyre slip, as well as mechanical and thermal stresses on the kiln, all on a centralised dashboard. Digital data is collected and saved in this dashboard. Moreover, it is easily integrated into the control room and plant DCS so operators can get a comprehensive,

Magnesita case study

One of HGH's clients, Magnesita Refractories, had been monitoring its shell's temperature and kiln burning process by hand using radiometers and simple methods. This was inefficient and made it near impossible to catch issues before a major event occurred.

After implementing Kilnscan, Magnesita experienced an immediate increase in efficiency as it was now able to monitor the quality of production, prevent excess ring formation, and detect single brick fall in the kiln. The reliability and utilisation of Magnesita's kiln significantly improved. Within the first year after implementing Kilnscan, there were no unscheduled kiln refractory failures and the plant operated 24/7.

“No hot spot, even temporary, will go unnoticed.”

centralised view of trends to support improved planning for kiln maintenance and refractory replacement.

Kilnscan is a standalone system that provides a centralised, 24/7 infrared kiln profile. The system dramatically reduces the amount of manpower required to achieve effective monitoring of the kiln shell. With a scan angle of up to 140°, Kilnscan has the widest field of view sensor available today, thus making it compatible with all plant configurations.

Similarly, Kilnscan has the highest resolution image on the market, with detection of single refractories at 150mm or less. Every brick in the kiln is accounted for with Kilnscan. In addition to its high spatial resolution, Kilnscan has an industry-leading thermal sensitivity of less than 1/10 of a degree Celsius, guaranteeing sharp and precise displays of temperature changes. Typical methods of monitoring temperatures along the shell use scanners with low resolution images, resulting in late warnings as these measurements rely on averaging the temperature peaks on a thermal map. Digitalising the monitoring process reduces the manpower required to continuously monitor the kiln shell for temperature spikes, and enables maintenance operators to make more efficient, calculated decisions for kiln maintenance.

Key to Kilnscan's power as a digital tool is its SIRCIM software. Kilnscan scans the entire length of the kiln at 25Hz, and is able to generate a complete thermal map of the kiln shell as it rotates. SIRCIM digests all incoming scan data, producing a 3D map of the rotating kiln that is continuously updated 24/7, so that any thermal evolution is easily detected and

Tianrui Group project, China

HGH's client at the Tianrui Group's Xingyang plant in China, with one of the world's largest single-kiln production lines, faced issues with other kiln scanning methods as the sheer size of the kiln engendered mechanical and thermal stresses, and encountered blockages by items in the field of view. With such a large kiln and high visibility projects, it was essential that the Xingyang plant find a monitoring solution with the highest resolution, widest scan angle and precise early detections and warnings to not miss a single brick fall.

Following the successful implementation of two Kilnscans with merged images, the Xingyang plant has used the centralised dashboard with 3D mapping and thermal warp calculations to facilitate easy planning for kiln relining and give operators the necessary information to locally cool down the shell as needed.

The Xingyang plant has since experienced no production interruption from breakdown or failure, and has benefited from increased productivity.

highlighted. No hotspot, even temporary, will go unnoticed. Customisable alarms with SIRCIM ensure that maintenance operators will be notified as soon as possible of any emergency and will be able to react quickly to avoid irreversible damage.

Within the 3D display, any particular point of interest can be selected for a more detailed view of the area displayed on screen enabling real-time identification of issues, down to a single refractory brick. SIRCIM's dashboard, with its remote monitoring capabilities and real-time insights, helps to centralise and streamline both data collection and maintenance efforts. The plant's manpower can be better spent on reducing downtime and preventing brick fall when they are relieved of manually monitoring the temperature map of the kiln shell.

Kilnscan's high-resolution scans coupled with SIRCIM's advanced algorithms provide operators with another unique feature: thermal warp

calculation. This function assesses, in real-time, the shell's trend to bend due to thermal inhomogeneities along its surface. Identifying trends of bending in the kiln is key in ensuring the long-term reliability of the kiln, including identifying load fluctuations on tyres and rollers to prevent tyre warp, as well as identifying cyclical stresses that can cause excessive load fatigue and reduce the kiln's lifetime. Kilnscan's digital visualisation of thermal warp highlights kiln axis distortion due to internal temperature gradients. With this visualisation on mechanical stresses on the kiln shell, tyres and the roller stations, operators can then act on the data to decrease shell distortion by adjusting the flame and rotation speed to adapt burning conditions, homogenise the coating and ultimately prevent hotspots.

Taking the guess work out of kiln monitoring

Digital capabilities of tools like HGH's Pyroscan and Kilnscan take the guess work out of kiln monitoring. 3D visualisations and trends help maintenance operators answer “what's going on inside my kiln?” to make better, data-driven decisions for planned maintenance. Operators leveraging historical data and tools like Pyroscan and Kilnscan will find that human monitoring of their kilns becomes unnecessary and their manpower is freed up to do other things. Similarly, the burning process is better managed and plants become more efficient and productive. ■

Kilnscan 3D thermal map

