CASE STUDY **KILNSCAN**

MONITORING ROTARY KILN SHELL TEMPERATURES IN REFRACTORIES

OVERVIEW

Customer: Magnesita Refractories – a world-wide leader in Refractory and Mineral Product Manufacturing, representing an aggregate production capacity in excess of 1,430 kt/y.

Challenge: By monitoring kiln shell temperatures manually, the plant experienced unforeseen shutdowns for refractory repairs and periods of poor quality production due to excessive ring formation.

Solution: Equipped Electro Optical Industries' Kilnscan system presented a perfect solution. The all-inclusive kiln monitoring system used high performance infrared sensors to provide live temperature data on the kiln shell, seeing all the way down to a single brick fall or slight product build up.

Results: After installation, the kiln had no unplanned refractory repairs and experienced increased kiln utilization while realizing improved product quality. Magnesita could focus on reaching their output potential and finding more customers for their product.

CUSTOMER

Magnesita is a vertically integrated refractory producer supplying to steel, cement, and various other industries. In addition, the company exports some of its raw materials and refractories to a wide range of countries. The company is the leading operator in refractory products in South America and serves customers in North America, Europe and Asia.

The Magnesita plant of regard is a dolomite refractories producer. The process involves mining, sintering, grinding and finally manufacturing (shaping) bricks. In the sintering process, the plant uses a rotary kiln system which takes milled dolomite and exposes it to prolonged high temperature. Kiln internal temperatures are in excess of 1600 degrees C. The end product is a densified mineral which can then be manufactured into various shapes as specified for each application.

CHALLENGE

Magnesita has a 90m rotary kiln that has been operational for several years. Historically, plant operators would monitor the process, specifically the external shell temperature, by hand using radiometers and simple methods from which they could determine if the shell needed maintenance or if there was an underlying major structural issue. This was very inefficient and inaccurate. Readings were not consistently taken on schedule or in the appropriate location. This would lead to unforeseen shutdowns for refractory repairs and periods of poor quality production due to excessive ring formation. Internal brick fall or product build-up would be nearly impossible to catch before causing a major event.

In 2011, there were multiple unplanned shut-downs, leading to reduced kiln utilization, increased energy consumption, and unplanned repair and sustainment costs.

There were several ways to monitor kiln shell operations including infrared scanning equipment. This would provide detailed, persistent thermal readings of the shell as it rotated and take away the reliance on monitoring by hand.

SOLUTION

After considering multiple solutions, Magnesita chose Electro Optical Industries' Kilnscan as it presented the highest performance and best all-inclusive solution to these issues. Their infrared scanning system provided the highest resolution and widest field-of-view sensor on the market. The software platform that it operated on was easy to use and included functionality that would help Magnesita keep the plant operating for a long time.

The Kilnscan system uses a fast scanning, highly sensitive infrared detector to capture the temperature of the shell, being able to detect a single brick fall within the kiln. Its ultra-wide field-of-view allowed installation of a single system to monitor the entire 90m kiln from a central location and using the existing infrastructure.

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Additionally to high spatial resolution, the Kilnscan has excellent thermal sensitivity: at less than 1/10 of a degree Celsius, it guarantees sharp and precise display of unwanted change in temperature.

The Kilnscan provides, through a user friendly 3-D shell display, precise alarms on critical parameters such as hot spots detection, tyre slip or coating loss. High accuracy of measurement needs to be consistent over time: by using the internal blackbody to measure and correct a potential slow drift of thermal measurement, the Kilnscan can recalibrate itself when needed, without operator's intervention. An external blackbody or the pyrometer are used only for correction of atmospheric absorption in case of bad weather conditions (fog, rain, snow…) to ensure the right temperature during these harsh conditions.

Historical data management of all relevant parameters, such as temperature profile, brick and coating thickness, kiln speed and tyre positions allows the production manager to get, at all times, a clear overview of the kiln status and trends in a centralized dashboard: as a result, kiln maintenance and refractory replacement planning improved.

Last, but not least, Kilnscan provides a unique advanced feature. The Thermal Warp Computation allows calculating the thermal distortion induced by temperature changes over the shell to let operators see what's happening within the kiln: evolution of coatings, kiln push of un-burnt material, potential stress on the shell, tyres or roller stations. By collecting and analyzing all the data, the plant manager can get indicators on:

- Mechanical and thermal stresses in the shell and tyres
- Hot spots under tyres
- Load fluctuation supported by each pier
- Shell and tyre distortion
- Breakage of tyres according to the fatigue criteria

With these data in hand, the operator can decrease the shell distortion by adjusting the flame and rotation speed to adapt burning conditions and homogenize the coating. Efficient shell distortion monitoring also results in avoiding hot spots.

RESULTS

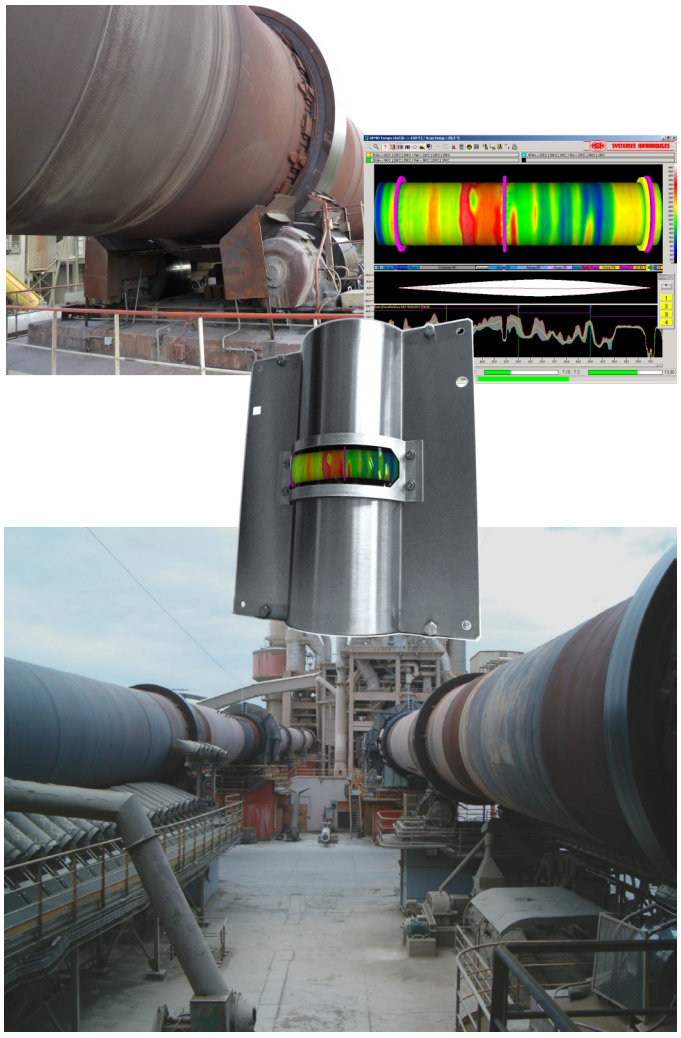
After installation, the process was immediately made more efficient. Operators were able to control the proper heating of the kiln and continued operation of the plant. There were no unscheduled kiln refractory failures and 24/7 operation was possible for just under a year. Operational costs were reduced as there were no major repairs needed and production was consistent and predictable.

Control room technicians became more reliant and trusting of the Kilnscan and human monitoring of the kiln was unneeded. Regular maintenance was more easily established, freeing up man-power to do other things.

Overall, kiln reliability and utilization improved. In fact, a second unit was ordered and installed in 2013.

CONCLUSION

When choosing a line scanner, the Kilnscan brings the best compromise between spatial resolution and thermal sensitivity in the line scanner industry today. Its advanced and unique software features allow for unmatched monitoring. The Kilnscan also offers the largest field of view available on the market (140 degree), which comes very handy when the line scanner has to be placed near the kiln. As the Kilnscan costs less than one day of lost production on average, it ensures that plants get the best return on their investment for years to come. With over 1000 units installed all over the world, some of them still consistently operating after 20 years in use, the Kilnscan remains the market leader of high performance line scanners.



Founded in 1964, Electro Optical Industries designs, develops, assembles and sells complete optronic systems for security, industrial and civil applications. EOI established itself as an international reference for infrared technology innovation through the development of its award-winning real-time 360 degree infrared camera, the Spynel (2008 Product of the year from Photonics Tech Briefs, 2010 Innovation Prize from the EuroNaval Committee, 2011 Kummerman award from the French Academy of Marine, 2012 GovSec Platinum Award). Tested by NSSA.

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