

REVISITTING RAPID RECOVERY AND REPAIR

**Florian Laux, REFKO Feuerfest GmbH,
revisits the performance of a lining
technology that has been used to repair
cement kilns in a number of different plants.**

Who would have thought that one year later the industry at-large would be facing problems with raw material procurement, fossil fuel supplies, temporarily closed industries, and a completely uncertain future? Things that many took for granted are becoming luxuries, and the refractory industry, with all of the industries both upstream and downstream of it, is also facing major challenges. This article will revisit some of the points made in an article published in the September 2021 issue of *World Cement*, and will also report on REFKO's experiences working with the material over the past two years.¹

A safely operating rotary kiln over the course of several months, for the best part of a year, within the scheduled inspection periods, is certainly the ambition of every cement producer. Unscheduled shutdowns cause high costs due to production losses and are, of course, anything but beneficial for the refractory material used. Unfortunately, unplanned emergency stops cannot always be avoided due to various factors.

This is exactly where the REFKO Recovery system

and in particular the concrete REFKO Recovery MG 78 comes in. This product was developed to repair damage in the lining, especially on old MgO/Spinell bricks. In the best case scenario, the kiln should continue to run safely and trouble-free until the next scheduled annual shutdown.

Preparatory work

Preparatory operations before any installation are mostly the same. The areas to be repaired must be cleaned and free of loose material from the old brickwork. The rubbish must be removed from the kiln so that it does not roll over the fresh lining during the rotation of the kiln during installation. An appropriate bond preparation of the surface is recommended. The spray application is carried out with a standard dry spraying machine/rotor spraying machine in combination with a booster pump and high-pressure membrane spray nozzle or 'REFKO nozzle'. The company also recommends a field division of four quarters, which can vary in width, but should be based on the joints of the old brick lining. To date, widths up to 100 cm have been undertaken. The widths



North Rhine-Westphalia: (top) old brickwork, almost dust-free gunning with field classification. (Bottom) final result after installation.

are also dictated somewhat by the format of the bricks.

Case study: Germany

Initial test cement plant: North Rhine-Westphalia, (Germany) January 2021

The initial field trial was carried out in cooperation with a German cement plant in January 2021, in fairly adverse conditions. On the one hand, a strong, seasonal frost, provided typical European climate conditions, although it is generally assumed that this material and lining concept are more likely to be used in the fall months from September onwards, since most annual overhauls begin in January and the kiln should simply be kept alive until then.

- ▶ Furnace length: 60 m.
- ▶ Kiln diameter: 3.8 m.
- ▶ Installation point: kiln 7 – 10 m (burning zone).
- ▶ Layer thicknesses: 10 – 90 mm (partly tapered to 0).
- ▶ Running time: 11 weeks.

Conclusion

Good adhesion with the old brick lining was achieved right from the start. In each case, whole quarters were sprayed in the corresponding lining width. After initial stiffening, the kiln was rotated, and quarter after quarter was sprayed. For the lining of an area of approximately 38 m³, a time of approximately 12 hours was required. After 24 hours of drying, the kiln was started up with the plant-specific heating-up curve without any problems or disturbances. Regular thermal imaging camera shots of the lining area were inconspicuous over the entire run time, which in any case indicated that there was no major damage to the lining. Even afterwards, during the main inspection, a residual thickness of the spray lining with REFKO Recovery MG 78 was still visible at all points, even where only a few millimetres had been applied.

Follow-up test cement plant: North Rhine-Westphalia, (Germany) January 2022

- ▶ Furnace length: 60 m.
- ▶ Kiln diameter: 3.8 m.
- ▶ Installation location: Furnace inlet, sintering zone, furnace outlet.
- ▶ Layer thickness: 20 – 160 mm.
- ▶ Running time: 4 weeks.

Conclusion

In the kiln inlet zone, the material held for a while. Once again, no abnormalities were detected by external temperature measurements of the kiln shell. During the inspection, however, the material was heavily worn. Due to low

temperatures, mechanical and chemical abrasion occurs in this area, the wear resistance is most likely insufficient here and must be replaced by another product from the Recovery range. The results in the sintering zone and the furnace outlet were completely different. It was possible to reproduce the results from January 2021. Decent residual thicknesses were visible and the protection of the old brickwork was still given.

Test cement plant: Lower-Saxony (Germany), December 2021

- ▶ Kiln length: 50 m.
- ▶ Kiln diameter: ~4 m.
- ▶ Installation location: sintering zone.
- ▶ Layer thickness: 80 – 140 mm.
- ▶ Running time: 8 weeks (until annual shutdown).

Conclusion

In this plant, REFKO had the opportunity to carry out the gunning up from a DAT-unit. This unit remained in the kiln because it was decided to use bricks in some areas, and to cover special areas with the Recovery MG 78 system. This gave a time advantage, since the ceiling shells could be sprayed without constant kiln rotation. The kiln was back in operation just 12 hours after the completion of the spraying work. The plant operator was very satisfied with the repair and can imagine stockpiling the material for unexpected furnace problems.



South Austria: Old masonry and discernible thickness of application, field grading, final result after installation.

Case study: Austria

Test cement plant: South Austria, September 2021

- ▶ Kiln length: 49 m.
- ▶ Kiln diameter: 3.4 m.
- ▶ Installation location: Kiln 14.20 – 15.60 m (burning zone).
- ▶ Layer thickness: 20 – 180 mm.
- ▶ Running time: 13 weeks (until annual inspection).

Conclusion

A damaged area was also repaired in the burning zone. The approximately 1.4 m was divided into two sections. The refractory consumption for this area amounted to 3.5 t of gunning material. The lining, including all necessary preparatory work, took 10 hours. According to the furnace operator, the lining with bricks in this area alone would have taken at least 24 hours, plus the effort of moving the appropriate equipment into the furnace. After the completion of all the work in the kiln it was brought up to operating temperature within 36 hours. Despite an emergency shutdown of the plant in the area of the cyclones one month after lining, the kiln ran through until the scheduled inspection and showed no abnormalities. Here, too, the Recovery system can be used as a preventive measure to extend kiln downtimes until the next scheduled stop.

Case study: Turkey

Cement plant: Northern Turkey, July 2022

- ▶ Kiln length: 60.5 m.
- ▶ Kiln diameter: 4.2 m.
- ▶ Installation point: Kiln 0 – 1.2 m (outlet zone + outlet cone).
- ▶ Layer thickness: 130 – 150 mm.

Cement plant: Northern of Turkey, September 2022

- ▶ Kiln length: 60.5 m.
- ▶ Kiln diameter: 4.2 m.
- ▶ Installation point: Kiln 18 – 23 m (burning zone) + kiln 0 – 1.2 m (outlet zone + outlet cone).
- ▶ Layer thickness: 100 – 150 mm.
- ▶ Running time: Both kilns are still in operation without any abnormalities.

Conclusion

In cooperation with their Turkish partner DAS Metalürji Makine San. Tic. Ltd. Şti, REFKO have been able to offer the Turkish cement works high-quality refractory solutions made in Germany. This successful cooperation also enabled them to gain a foothold and carry out

initial trials with the REFKO Recovery MG 78 outside the EU. Here, too, the company were able to continue the series of successes. The area to be repaired has now lasted for 3 months and the factory has reported no abnormalities. Based on this, several parts in kiln 2 and kiln 3 were scheduled for repair in October 2022. The operator was enthusiastic about the opportunity for dust-free spraying, quick repair, and the possibility to heat up without a specific heating plan. In this particular case, the kiln was back up to operating temperature in less than 24 hours after the gunning work was completed. Whilst this is not a procedure that the company would want to propagate or advertise, it nevertheless shows the flexibility and properties of this unique product.



Turkey: Old brickwork outlet zone, before and after installation with REFKO Recovery MG 78.

Results/outlook

So far, REFKO Recovery MG 78 has been able to demonstrate itself as a product that enables fast, safe, and successful temporary repairs in the rotary kiln. The product allows advantages in production speed, flexible-use, and low energy input. Especially in the current situation, this makes an even greater contribution to CO₂ and energy savings. It eliminates the need to break out the old delivery and thus saves time and money.

Based on these results, REFKO constantly strives to expand its product portfolio to cover all the requirements of the repair process in the rotary kiln. New products have already been developed and are currently in the trial phase with end customers willing to try them out. REFKO, and some of its customers, are confident that this material is capable of much more, such that they are planning to monolithically line some areas with this material at the next opportunity.

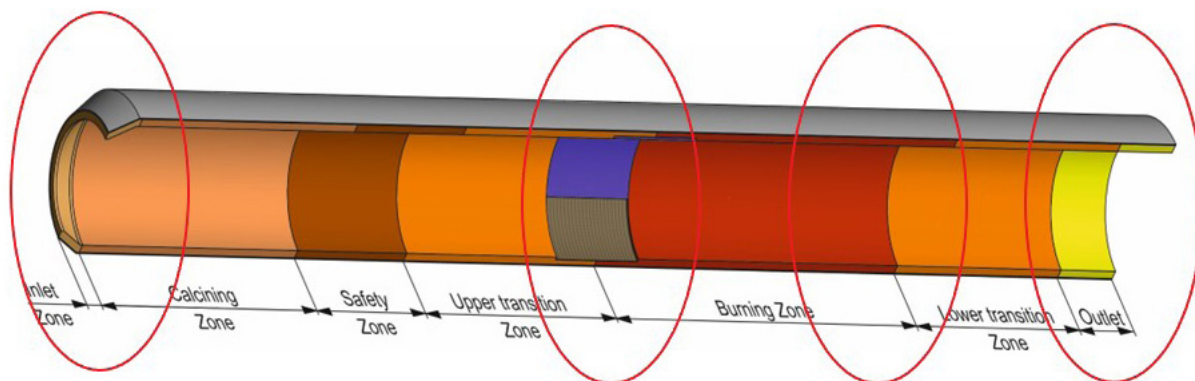
The company is also considering expanding its warehouse network worldwide in order to enable fast deliveries in many parts of the world within a few days. ■

References

1. HOENL. H., 'Ready For Rapid Recovery & Repair', *World Cement*, September 2021, p. 43.

About the author

Florian Laux is the head of Product Development at REFKO Feuerfest GmbH. After finishing his diploma thesis in 2013 at the University of Applied Sciences Koblenz in cooperation with the company REFKO Feuerfest GmbH, he started in the R&D and QM department in the eponymous company and was involved in the development of new refractory materials, product concepts, and technical solutions. Florian is now also a Partner in the company.



Installation areas of the previous field tests until now.