Coat or Corrode: Protecting the Kiln

Linas Mazeika, 3L&T Inc., discusses the application of a corrosion-resistant coating in the kiln of a Mexican cement plant.

Introduction
The corrosion of the shell in the rotary kiln of cement plants can be a very serious problem. In some cases, the damage is so severe that an entire section of the kiln needs to be replaced. The total maintenance cost and production loss can be in the hundreds of thousands of US dollars.

When visiting a cement plant in South America, this author first learned how scary the corrosion damage in a kiln can be. The plant was operating on a weekend, when the kiln broke and fell to the ground. Fortunately nobody was injured.
3L&T has developed several ceramic coatings before; now the company focused on a material that would hold up to 600°C, would be very abrasion resistant, and would be immune to the attack of the hot acids that condense on the inner wall of the kiln. This was the beginning of the KilnGard™-600SCW material. To date, 3L&T has protected more than 50 kilns worldwide – and the trend continues.

A major issue
Kiln corrosion in the past was not a major issue. In recent years, however, the issue is getting much more severe. There are two current practices that correlate with this trend for more aggressive corrosion: higher sulfur in the fuel and the increase in the use of alternative fuels that contain chlorides. Figure 1 shows the corrosion of a kiln section of a CEMEX plant; it was damaged to the point that it had to be replaced.

The replacement of the corroded section was done at the Huichapan cement plant, north of Mexico City, during May 2017. CEMEX started production at its Huichapan plant in 1986, using advanced industry technology to distribute cement to builders in the central part of Mexico. With the plant’s production capacity of more than 1 million tpy of cement, the company’s installed capacity exceeded 10.7 million tpy.

The first application of KilnGard-600S was made in 2008 in a kiln section that was experiencing severe damage. The inspection a year later showed good protection. Based on these results, the maintenance management decided to protect more sections of both kilns during the yearly maintenance shutdown. So far eight applications have been made, the one shown in this article is the most recent (Figure 2).

Application
All steel surfaces to be coated need to be blasted using sand or slag to Near White NACE 2, SSPC SP-10 or Swedish Standard SA 2-1/2 cleanliness. All surfaces to be coated must also be completely dry, as well as free of rust, moisture, soil, dust, and grit.

The profile of the surface to be coated, after sandblasting, must be a minimum of 3 mils (75 µm) peak to valley. The surface profile is critical for the future performance of the KilnGard-600SCW, because it doubles the effective area of contact with the metal surface. Figure 3 shows the sandblasting in progress.

To prepare the coating, the one gallon white liquid Part B is added into the five gallon pail, containing four gallons of the red KilnGard-600SCW Part A. It is then mixed with a suitably sized power mixer for about 5 min.

For the application, a pressurised pot, such as the Binks Pressure Tank 83Z, and a speciality gun for heavy body fluids, such as the Binks Model 7D, are used. Do not use airless spray for the application. The average required dry film thickness is 20 mils (0.5 mm). The low and high shall be in the range of 20 ± 2 mils (0.5 ± 0.05 mm).

Figure 1. Corrosion damage in a cement kiln.
Figure 2. Installation of the new section.
Figure 3. Sandblasting of the kiln shell.
Figure 4. Air spray of KilnGard-600SCW in progress.
15 – 25 mils (0.38 – 0.63 mm). The minimum acceptable dry coating thickness is 15 mil (0.38 mm). Any sections below 15 mils (0.38 mm) must be fixed to 20 mils (0.5 mm) before the final cure. About four hours at 23°C (72°F) should be allowed for the coating to dry to a tack free film.

Figure 4 shows the application in progress. After drying at room temperature for 12 – 24 hours, the bricks can be installed as usual. The KilnGard-600SCW coating reaches its ultimate physical and chemical properties after heating in the kiln during the startup process. At 200°C of metal temperature on the shell, it takes about 8 hours to complete cure.

The recommended method to monitor the corrosion protection of the kiln shell is by measuring the metal thickness along the kiln. 3L&T recommends measuring every meter. The initial measurement spots shall be marked, so that the follow up measurements are done in the same location.

This kiln is currently in operation. It is expected that, during the next shutdown in May 2018, the plant will be able to follow up on the corrosion protection of the coating.

**Conclusion**

Kiln corrosion can be a severe additional problem in cement plants and, when it happens, it can be very costly. Shell corrosion has been more aggressive in recent years. This is due to several factors, most importantly the increase of sulfur and chlorides in the gases coming from the fuels.

KilnGard-600SCW can be applied during kiln shutdown. The new refractory is installed on top of it, and the ceramic coating is cured in place during the normal start of the operation.

Since 2011, KilnGard-600SCW has undergone several formulation changes in a continuous effort to further improve material performance and mitigate or eliminate some remaining drawbacks. Compared to Version 3 from 2011, the current Version 7 of the formulation has longer shelf life, it is less prone to blistering, and is more resistant to cracking and delamination when subjected to long-term acid and salt spray weathering tests (3L&T M-14). Abrasion resistance is also improved: material loss after 1000 cycles on Taber abrasion tester (ASTM D-4060), using a CS17 wheel, decreased from 35 mg to only 20 mg.

The newest Revision 8 is currently under long-term testing, and is showing promising initial results. If everything goes well, we expect to take it into production early next year.

**About the author**

Linas Mazeika is President and CEO of 3L&T Inc.