CASE STUDY:

Titanium Dioxide Pigments

TIVAR® 88 High Performance Lining Solution

THE CASE IN BRIEF

Application: Titanium Dioxide and Titanium Ore Handling
Quantity: 15 silos (700 m^2); 10 bunkers (400 m^2)
Liner: TIVAR® 88 w/Antistatic package, 10mm Thick; TIVAR® special formulation, 10mm Thick
Bulk Material: titanium ore (ilmenite); titanium dioxide; titanium dioxide pigments
Substrate: ST 37Steel
Problem: Caking, bridging
Date Installed: ore bunkers - 1985-87; dioxide silos - 2000-03

TIVAR® 88 SPECIAL FORMULATION AND TIVAR® 88 ANTISTATIC IMPROVE TiO_2 HANDLING, QUALITY

Background: Kronos Titan, Leverkusen-Nordenham/Germany, is one of the leading producers of titanium dioxide pigments, producing approximately 450,000 metric tons each year. Titanium dioxide (TiO_2) pigments are produced by converting ilmenite ore, ilmenite soaps, rutile beach sand or anatase slag. Conversion occurs using a sulfate or chloride process.

Problem: During the early 1980's, Kronos Titan began experiencing severe caking and bridging in the bunkers during the transport and storage of titanium ore due to extremely small particle size in the case of the ore and pigments of only µm size. In addition, the silos used to store the titanium dioxide and titanium dioxide pigments were subject to caking and bridging. Material flow was often interrupted and resulted in converted products that were non-uniform. Active flow devices such as air cannons and vibrators were used on a regular basis, an additional operating expense in terms of man-hours to run the equipment and repairs to damaged bunkers and silos.

Solution: Kronos Titan made the decision to address the caking/bridging issues in the bunkers first and then focus on eliminating problems in the silos. In 1985, they began working with SystemTIVAR® Engineering to analyze the physical properties of the titanium ore as well as the wall angles in the bunkers. Results from the practical testing indicated that the caking and bridging could be eliminated by installing 10mm-thick proprietary formulation TIVAR® linings. Between 1985 and 1987, these specially formulated TIVAR® linings were successfully installed in all 10 bunkers.

With the bunker material flow issues addressed, the team turned its focus to the silos. Several different lining materials were examined and field-tested to determine performance levels and economic feasibility. The success of the bunker linings and the results of material flow/silo geometry tests indicated that the silos should be lined with TIVAR® 88 w/an antistatic package in order to achieve mass flow. All 15 silos were lined by 2003.

In both applications, vertical butt joints were welded and smoothed, the corners of the storage bunkers were lined with preformed shells and leading edge protectors were installed to ensure mass flow.

Results: After nearly 15 years in service, the bunker linings are performing as well as when they were first installed. According to staff, there is some visible wear, but not enough to negatively impact the liners' ability to keep the Titanium ore from caking and bridging. Routine inspection has been the only maintenance performed on the liners since installation. The TIVAR® 88 linings in the silos are also performing very well according to Kronos Titan staff. The use of air cannons and vibrators for both the silos and bunkers has been eliminated and maintenance expenses have been significantly reduced.

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