

Sticky Rock is unstuck

by AJ Weller Corporation, USA

The double-edge problem of sticking and abrasion at Florida Rock has apparently been solved by AJ Weller Corporation who recently redesigned the Polysius raw mill and improved material flow. A second project at the Newberry plant involved increasing wear resistance in the clinker dedusting system.



Florida Rock Industries, Inc, headquartered in Jacksonville, Florida, is a major basic construction materials company operating a cement plant located in Newberry, Florida. The Newberry plant has a permitted operating capacity of 800,000tpa of cement. In operation since December of 1999, the plant has been experiencing start up challenges that only become evident during production.

Florida Rock is using a Polysius system that includes a single vertical roller mill with a rated capacity of 192stph. The table is 135 inches in diameter with 75 inch rollers operating at 26.7rpm, being pushed by 1750hp. The mill can easily provide more than enough raw material feed to operate the kiln at maximum efficiency.

Before the first clinker was produced, Newberry's management team realised that the high moisture content of the raw materials would cause a processing flow problem. Pre-production testing assured Newberry's operation management that moisture levels would remain around 11 per cent an ideal level to maximise production. However, moisture levels actually ranged from 11 to over 13 per cent. The high moisture levels coupled with the high clay and silica content of the raw feed mixture presented a 'double-edged' problem. When the moisture content is under control, the raw feed flows well, however, the high silica

content of the raw feed created a significant wear issue. Conversely, high moisture and clay content causes the material to plug, stopping the process completely. This was the problem that Florida Rock Industries management team faced after its first year in production.

Design programme

Due to the original inlet feed chute design, material was plugging at a rate that caused the mill to be shut down every 8-10 hours. Maintenance was then forced to enter the mill and clear the plug 'round the clock'. Kiln production was threatened daily. Frequent entering of the mill and cleaning the pluggage became a real safety concern.

The raw feed entering the mill was measured at four inch minus. When flow was not restricted, the impact point on the chute was facing two kinds of wear problems: heavy impact from the size of the material and high abrasion from the silica content. The straight-sided chute with its' 90° angles allowed material to pack and bridge.

The AJ Weller Corporation was asked to help to solve this complicated issue. AJ Weller, a 20-year-old company located in Shreveport, Louisiana has earned a reputation solving difficult wear problems. The products and/or solutions offered by AJ Weller include a complete line of premium wear resistant materials for various industries.

AJ Weller identified two major problems: (1) redesign of the raw material inlet feed chute eliminating all the sharp corners and angles; and (2) identify a material that can promote flow ability and that could handle the impact and high abrasion of the feed stock.

Solution

The original equipment chute liners were not promoting flow, nor supplying the

level of protection needed to give the expected service life. Stainless steel liners partially relieved the flow issue but offered relatively little protection from impact and abrasion.

AJ Weller designed a material to fit the demands of the application and customised it to fit Florida Rock's expectations: WellerCLAD HYPOL™, WellerCLAD™ and WellerCLAD HCLAD™ are a combination of chromium carbides, manganese, and vanadium in an iron base that are metallurgically bonded to steel with a low temperature fusion process to maintain the integrity of the materials.

The unique chemistry, high chrome and other alloys lend excellent lubricity, promoting flow. The carbide size, density and consistency provide a super tough wear surface that stands up well to the high abrasion. The fusion process makes the material tough enough to absorb the heavy impact without degrading or spalling.

Given AJ Weller's expertise in flow promotion, it was understood that WellerCLAD in its standard delivered form, would not satisfy the material flow ability issue. AJ Weller incorporated its' proprietary HYPOL method to provide a surface finish that substantially increases particle flow by lowering the coefficient of friction, without effecting the toughness, or wear resistant characteristics of WellerCLAD.

Installation

Florida Rock's Management Team made the decision to go with WellerCLAD HYPOL. Preparations were made to install the liners during the Spring of 2001. The liner system was supplied cut to fit and arrived ready for the job. The maintenance team welded each liner in place and used narrow strips of WellerCLAD HYPOL in the corners of the chute to open the angles. The steel backing on the material made

for quick and easy installation with standard welding equipment and rods. Installation was completed without any surprises and the mill was brought back on line with the rest of the plant.

Since the initial modification and installation of WellerCLAD HYPOL, the raw feed chute has operated with significant efficiency. Florida Rock went from 8hpd shutdown to 3h/wk; with subsequent modifications the maintenance team has eliminated pluggage in the chute completely. As of October 2002, the WellerCLAD HYPOL liners show negligible amounts of wear and continue to offer protection to the chute structure. Related safety issues have also been drastically reduced.

Multi-dimensional processing problems require solutions that supply answers to all facets of an application. Today's leaders in the cement industry know the value of utilising all of the assets available to them. Forward thinking and dedication from the maintenance team at Florida Rock coupled with the technology resources of AJ Weller met the sticking and abrasion problem in the raw feed chute head on and won.

Wear problems

A second contract for AJ Weller at Florida Rock Industries concerned the problems of tackling high wear problems since the plant's commissioning has been a strategic focus for the maintenance management team at Florida Rock. Wear in the clinker dedusting system has caused many hours of maintenance manpower, loss of efficiency, and safety concerns. The system incorporates a 'Grasshopper' elbow to control the speed and flow of the clinker dust to the electrostatic precipitator (ESP).

The high abrasiveness of the clinker dust has continually attacked the elbow causing frequent attention and repair. The need to eliminate or drastically reduce the

wear issue in the elbow was evident and Florida Rock turned to AJ Weller for the solution.

Designing an upgrade

The original duct system was standard issue as supplied from the OEM. Almost from the beginning of production, wear problems began to appear. The tremendous velocity of the particle laden dust stream coupled with the high temperatures coming off the clinker cooler was eroding the elbow and duct system. Pushing full capacities exacerbated the wear rate thus increasing maintenance requirements and patching.

The AJ Weller was asked to help solve this complicated issue.



Installation at Florida Rock

Turnkey solution

The original duct wore out after three years of production. AJ Weller was asked to provide a turnkey solution that would eliminate the wear problem and continue to operate within the system's requirements. Working in conjunction with the team at Florida Rock, AJ Weller designed, fabricated and delivered a new elbow lined with WellerDensit™.

WellerDensit is a chemically bonded ceramic liner that is specifically designed to prevent severe pneumatic wear and fine particle abrasion. It is a mixture of ceramic materials and premium wear resistant aggregates that create a trowellable, castable, or sprayable liner for wear protection.

The product is prepared by mixing the compound with a small amount of water in a specially designed paddle pan mixer. This starts a chemical reaction that hardens the product to a solid, ultra dense state. Typically, the mixture sets in 45 minutes and reaches working hardness in 1-2 days, depending on the temperature when applied.

AJ Weller believed it could help Florida Rock by utilising this product on the grasshopper elbow to eliminate the continuous wear.

The WellerDensit technology is advantageous for a number of reasons: the wear liner makes use of a mechanical bond in the form of an expanded metal mesh, that is welded onto the inner steel surface to be protected, offering many advantages. The difference in thermal expansion between steel and the ceramic composite material becomes absorbed, so broad cracks and the risk of spalling are avoided.

In addition, the mechanical bond allows the structure to become self-supporting. The product is seamless in design and can form to extremely complex geometric shapes.

Installation

Florida Rock's previous experience with WellerDensit allowed it to make an informed decision much easier. AJ Weller supplied the elbow in two pieces for easy field installation. The Florida Rock management team commented that the workmanship of the fabrication provided a superior fit to the existing system and no installation modifications were necessary. Thus far, Florida Rock's expectations have been fulfilled and the elbow is now performing correctly during production.

Conclusion

Pneumatic wear processing problems require solutions that supply answers to all the facets of an application. The ability to form a monolithic, chemically bonded ceramic liner without seams or exposed fasteners reduces wear and enhances air flow.

WellerDensit solutions provide a unique and proven alternative for heavy industrial processing plants with extreme fine particle, high velocity abrasion. Florida Rock Industries and AJ Weller took on a serious processing and maintenance issue and eliminated it.



New elbow equipment to solve Florida Rock's dust problems