Tackling Restricted Flow and Abrasion

Ken Ryan, A.J. Weller Corp., USA, looks at the double edge problem of sticking and abrasion.

Introduction

Florida Rock Industries, Inc., headquartered in Jacksonville, Florida, USA, is a major basic construction materials company operating a cement plant located in Newberry, Florida. The Newberry plant has a permitted operating capacity of 750 000 tpa. During 2001, the cement plant sold 682 000 t or just over 90% of the rated capacity. In operation since December 1999, the plant has been experiencing start up challenges that only became evident during production.

The plant uses a Polysius system that includes a single vertical roller mill with a rated capacity of 192 tph. The table's diameter is 135 in. dia with 75 in. rollers operating at 26.7 rpm, 1750 Hp. 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 the plant's operation management that moisture levels would remain at approximately 11%, an ideal level to maximise production. However, moisture levels actually ranged from 11 to over 13%. These high moisture levels, coupled with the high clay and silica content of the raw feed mixture, presented some double edged problems. 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

Due to the original inlet feed chute design, material was plugging at a rate that caused the mill to be shut down every 8 to 10 h. Maintenance was then forced round the clock to enter the mill and clear the plug. Kiln production was threatened daily. As the mill had to be frequently entered to clean the pluggage, safety concerns were raised.

The raw feed entering the mill was measured at -4 in. 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 severe abrasion from the silica content. The straight sided chute with 90° angles allowed material to pack and bridge.

The A.J. Weller Corp. was asked to help to solve this complicated issue. The 20 year old company located in Shreveport, La, has earned a reputation for solving difficult wear problems. The products and solutions offered include a complete line of premium wear resistant materials for various industries.

The company identified two major problems which were as follows:

- Redesign of the raw material inlet feed chute eliminating all the sharp corners and angles.
- Identification of a material that could 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 or supplying the level of protection needed to provide the expected service life. Stainless steel liners partially relieved the flow issue but offered relatively little protection from impact and abrasion.

A.J. Weller designed WellerCLAD HYPOL™ to fit the demands of the application and customised it to fit Florida Rock's expectations.

WellerCLAD™ and WellerCLAD HYPOL™ are a combination of chromium carbides, manganese, and vanadium in an iron base that are metallurgically bonded to

Florida Rock's Newberry plant, Florida, USA.

Dorol-RMR41-20-315 roller mill.

Raw feed inlet chute.

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 which promotes flow. The carbide size, density and consistency provide a 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.

It was understood that in its standard delivered form the material would not satisfy the flow abilty issue. A.J. 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 the material.

Installation

Preparations were made to install WellerCLAD HYPOL™ during Spring 2001. The liner system was supplied cut to fit and arrived ready to be installed. The maintenance team welded each liner in place and used narrow strips 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 problems and the mill was brought back on line with the rest of the plant.

Results

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

Conclusion

Multi-dimensional processing problems require solutions that supply answers to all the facets of an application. Forward thinking and dedication from the maintenance team at Florida Rock coupled with the technology resources of the A.J. Weller Corp. resulted in the sticking and abrasion problems in the raw feed chute being overcome.