Prevention and Protection

Introduction to maintenance

The machines and systems used in the production of cement are subject to extreme wear and tear due to the processing of very hard minerals. In order to maintain a high level of plant production and to ensure the quality of the product, preventative maintenance in regular intervals is essential. As a result, maintenance plays a significant role and is also a substantial cost factor in determining whether a company is profitable or not. Optimum maintenance of individual plant components must be considered on an individual basis and carried out separately depending on various criteria such as maintenance frequency, accessibility, preliminary financing costs, and the shutdown of the plant.

Taking into account the criteria mentioned above and based on a few examples, the report that follows deals with different maintenance options for wear and tear parts.

Transport and storage

Storing and bunkering

Transfer points, in particular the edges, are subject to heavy wear during the transport and storage of bulk goods. For this reason, additional measures to protect against wear are required on the edges of truck flat beds, loading shovels, and on the entry and exit points of bunkers.

These edges can be welded with VAUTID 100 hardfacing to protect against abrasive wear. This can be used to achieve the same component service life as with other plant components, in spite of the increased abrasive wear, and it also eliminates the need to employ additional maintenance measures in this area. This measure of wear protection is often implemented in the plant, but paid for with machine downtime. In order to reduce these downtimes, or if larger areas must be protected, wear plates are a more efficient solution. These wear plates

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Figure 1. Loading equipment used for raw material transport in cement plants.

have been coated with the same hardfacing material and are manufactured industrially on a large scale. They can be purchased at the exact size and shape required for mounting. This results in cost savings and reduced downtime.

Screw conveyors

Screw conveyors are used for transporting materials in brick making plants and power plants. They are also used during the construction of tunnels and for unloading ships. Abrasive, and to a lesser extent, corrosive wears often occur during the transport of these devices. Hardfacing with VAUTID 150 can increase the service life when using the equipment in the ceramic industry, since this hardfacing has a good combination of abrasion and corrosion resisting materials. Here, the edges of the equipment are subject to very heavy wear. An additional hardening layer with VAUTID ULTRA 303, which is produced on a tungsten carbide basis, is recommended as edge protection. Another option would be to manufacture the screw spiral with VAUTID composite plates (can be purchased pre-cut and bent ready for installation).

Figure 2. Screw conveyor with spiral crown hardfacing.

For a larger number of units, VAUTID-castings are also recommended as a potential solution and are already being used successfully by other manufacturers.

This is how the screw spiral is manufactured with iron cast components for an 800 mm dia. screw conveyor system used for tunnel construction. The spiral's crown, which is subject to extreme wear, is assembled with segments made of bi-metal cast iron. These bi-metal cast iron parts consist of 50% wear resistant chilled casting materials and 50% cast iron steel. The segments can then be welded together and attached to the screw as a crown. This increases the service life of the screw by 3 - 5 times in comparison to a conventional steel solution. If required, these bi-metal cast components can be regenerated, which costs substantially less than purchasing a new screw conveyor.

Screw conveyors are also used to transport bulk goods when unloading ships. These conveyors are manufactured using a combination of steel sections, cast iron steel, and chilled cast components. The screw flights made of chilled chrome casting are screwed onto the base structure for this application.

This simplifies connecting the wear resistant screw flights and also offers an easy-to-maintain solution if one of the wings must be replaced due to intense wear.

Hardfacing of grinding rollers and grinding discs

Over the past few years, a transition could be observed in fine grinding plant technology. For decades, ball mills were used exclusively in cement plants. These mills are gradually being replaced and vertical roller mills and high-pressure rolls are primarily used today. These are applied in the cement industry as well as for raw meal processing, the grinding of blastfurnace slag, and for brick grinding. The components subject to wear, such as the grinding rolls and the grinding discs, have been regenerated since 1998 with VAUTID. In 2004, VAUTID won a 5-year contract with a large cement producer in South America, promising to lengthen the part replacement cycle by 30% and thereby increase profit. This increase in the service life was achieved by applying the technology of hardfacing for protection against wear. The experience with the VAUTID products was so positive that the contract was extended to 2015. The service life achieved with VAUTID products was increased once again in 2008 by optimising the hardfacing material. The company has shown that hardfacing is feasible up to 152 mm. This is how part replacement cycles can be lengthened and operator costs reduced. The experience gained by regenerating the grinding rolls and grinding discs was utilised in a further project in 2007. At this time, segments of a grinding disc were coated with the material VAUTID W73 and then welded with a hardfacing combination of VAUTID 100 and VAUTID 143. This combination enables a long service life through the use of hardfacing materials and provides an extra margin for wear in the cast part for continuing production in case the grinding elements cannot be replaced as planned.

Applications in beater mills

The beater mill material is accelerated at high speeds up to 70 m/sec and then thrown against an impact surface. During this process, blow bars made of chilled chrome casting and hammers made of bi-metal castings are used. Bi-metal hammers are tools with an underlying steel surface that connects the working surface made of chilled chrome casting. This combination of materials has connector elements on the steel surface that can be machined mechanically and used to connect other system components through joint welding. The chilled casting side of these components is also very resistant to wear.

By using bi-metal hammers instead of hard manganese steel, the service life of the respective components in the South American cement plants could be increased from 6 to 46 weeks. This resulted in significant savings (with regard to maintenance and repair costs), a minimisation of the downtimes and a consequent increase in productivity based on longer machine operating times.

Beater mills used for grinding coal are protected against wear with partial hardfacing on the impact plates and selective hardfacing of bi-metal plates. The first third of the impact plate was targeted for regeneration with VAUTID 100Mo, since this is the area of the plate that is subject to the most wear.

This provided a more cost efficient solution than the replacement of the entire impact plate. Furthermore, the use of the VAUTID material leads to a significant increase in the tool-service-life when compared to all of the other alternate products that were tested.

Summary

When abrasive materials are transported or stored, wear occurs primarily on the edges, e.g. exit and transfer

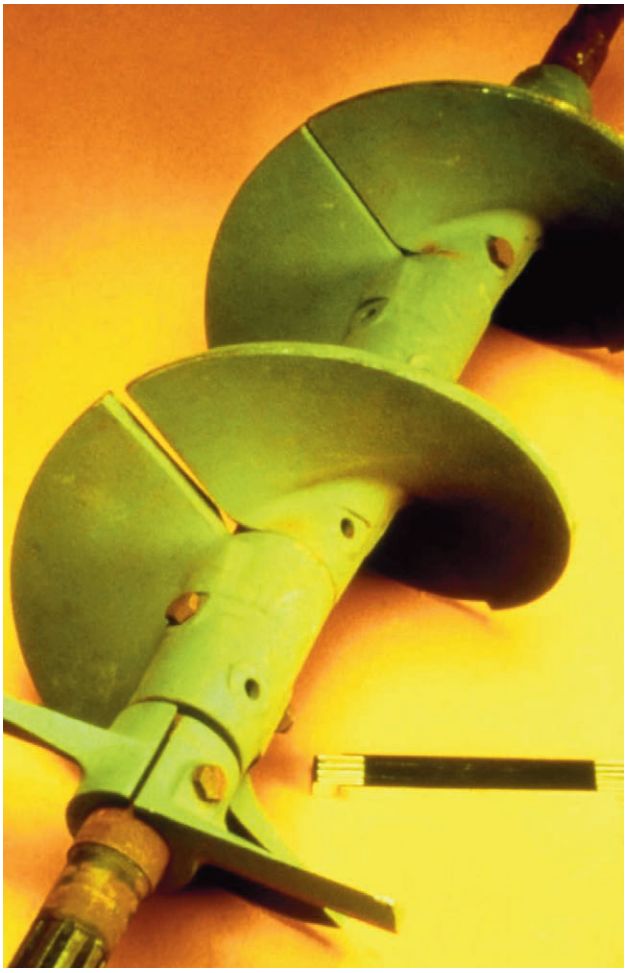

Figure 3. Screw conveyor with cast iron spiral.

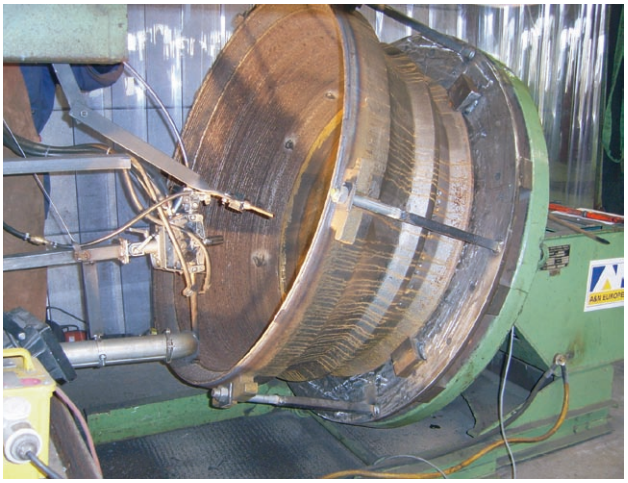

Figure 4. Regeneration of a crusher shell.

Figure 5. Impact plate with typical wear pattern (top) and partial new hardfacing (bottom).

points. In most cases, partial protection against wear through the hardfacing of these positions is sufficient to equally extend the service life of the rest of the equipment. The spiral crown of the screw is subject to extreme wear through abrasion and necessitates the partial or full surface protection of the screw against wear. This can be accomplished with hardfacing or by attaching cast parts made of bi-metal for screws with oversize diameters. Grinding rollers and grinding discs can be regenerated repeatedly with hardfacing. The welding can take place on the component while installed (in-situ) or after removal. An emergency reserve layer still exists on the wear resistant base material after the protective surface is worn down when chilled chrome casting is used as a backing material. By using such hammers, made of bi-metal instead of hard manganese, the service life was substantially increased for applications in beater mills. Impact plates in coal mills could be regenerated with partial hardfacing, thereby increasing service life in comparison to the solutions that were originally used.

Protecting components against wear in cement plants is one of the main maintenance topics and the proper application of these protective measures plays an important role in controlling maintenance costs. In order to develop an appropriate measure of protection, each individual application must be analysed separately depending on the occurrence of the wear. Casting and welding methods offer a wide range of solutions for reducing expenses associated with maintenance issues.