

Piping systems: Under attack from all directions

Conveying highly abrasive materials such as is done in pulp and paper applications, steel piping systems are under constant attack from abrasion as coal, limestone, wood chips and fiber, and debris are transported in slurry – often over long distances.

To combat abrasion and keep piping systems in service as long as possible, the industry solution has been to install abrasion resistant (AR) pipe that is much harder on the Brinnell Scale than standard steel pipe. The harder the inner wall, studies have shown, the better it resists the gouging or plowing action of abrasive sliding particle flow. Unfortunately, this type of abrasion is only one type of wear experienced within the piping system.

Impact abrasion, where a slurry meets the inner pipe wall at closer to 90 degrees such as at bends, elbows, laterals or tees, has a decidedly unwelcome effect on the inner wall of the pipe.

At sharper angles, abrasive material actively “chips” away at a more brittle inner wall, eroding the surface from the inside out. So predominant is the problem that frequent replacement, repair, and the associated maintenance expenses at the bends, elbows, laterals and tees in the system are accepted as the norm.

“When you have a sharp impingement angle, the abrasive material in the slurry can chip away at a brittle inner pipe wall,” explains Ralph Wollenberg of Port Washington, WI-based Ultra Tech, a company specializing in a variety of abrasion resistant pipe and pipe accessories for a range of industries. “On the

other hand, a more ductile inner wall deforms on impact and is better suited to withstand impact abrasion over time.”

So, the solution would appear straightforward. For sliding abrasion, an extremely hard interior pipe wall for the straight lengths of pipe and a more ductile inner wall at the directional transitions? Not so fast. It turns out size transitions and directional changes can experience *both* abrasive and impact wear.

According to Wollenberg, the variety of considerations that need to be addressed when it comes to abrasive wear illustrates the difference between simply ordering a piece of pipe and the broader field of piping system design.

“Designing a piping system is really a balancing act and each system is different,” says Wollenberg. “In some cases, if the abrasive material is softer than the steel used for the bends and it’s not moving very quickly, even an impact situation will not wear away the pipe. If the abrasive material is very hard or being conveyed at a higher velocity, alternative solutions at the directional transitions are required.”

Wollenberg says that solutions include induction hardened pipe bends, installing wear tiles and inserts, lining the bend with various abrasion resistant materials and designing-in longer radius bends when possible.

Induction hardening of bends

Strength and wear resistance can be improved by the addition of alloying elements to the steel during pipe manufacture. This material is commonly referred to as AR200

(abrasion resistant) piping.

Strength and wear resistance can also be increased with secondary processing of the steel including heat treatment by induction hardening. Induction hardened pipe can last three to eight times longer than mild steel, with only a moderate price increase.

Several years ago, Ultra Tech released its Ultra 600 series induction hardened pipe, a unique single wall pipe with a 250 BHN ductile outer surface that tapers to a 600 BHN inner wall surface.



“Designing a piping system is really a balancing act and each system is different,” says Ultra Tech’s Ralph Wollenberg.

The process begins with a steel pipe manufactured to a proprietary chemistry developed by Ultra Tech, followed by induction heating, and finally water quenching of the inner surface to create the single wall pipe.

At 600 BHN the inner wall of the pipe can withstand the sliding abrasion of most common mining slurries, while its more ductile outer surface behaves like mild steel and can be cut and welded with proper procedure in the field, configured into a variety of fittings and can accept the standard end options of flanges, weld rings and couplings.

Using this proprietary process, Ultra Tech can create

pipe in various diameters up to 40-in. in varying lengths and wall thickness. The same technology is used to create the bends, elbows, laterals and tees with the same hardness profile.

Based on the premise that when two objects meet the harder object wins, induction hardened pipe for both straight lengths and directional transitions is often sufficient for slurries of “softer” material such as coal and limestone. In some cases, mild steel pipe with induction hardened bends may work as well.

Increasing the bend radius

Another legitimate technique to mitigate the effects of impact abrasion is utilizing induction hardened pipe in long radius bends.

“If there is enough room, you can design the bend with an impingement angle of less than 15 degrees, which is a small enough angle that you no longer have impact abrasion but essentially sliding abrasion,” says Wollenberg. “With a large enough bend, to all intents and purposes you have made it a straight pipe.”

Because Ultra Tech is able to induction-harden the pipe during bending, it can vary the arc radius of the pipe from 20-in. to 180-in. and handle multiple diameters or thicknesses of pipe.

“The bending process has added benefits, in that it’s much easier to reduce the ovality that one sees so often with a cold bend,” says Wollenberg. “Although you will still get some wall thinning – depending on the radius of the bend – it is much less than a cold bend.”

Wear tiles and inserts

A layer of wear tiles can also protect the inside wear surfaces of the pipes. Industrial wear tiles are made from materials that are harder and more abrasion resistant than the base piping.

These tile materials can be cemented carbide, cast high chrome and ni-hard, aluminum oxide and basalt. Cemented carbide tiles are usually quite small (about 1 in. (25 mm) square and ¼-in. thick). Aluminum oxide tiles can be almost any size and have thickness over 1 in. Basalt is a naturally occurring igneous rock that can be molded and cast into shapes, while retaining hardness between 8 and 9 on the Moh’s scale.

Wollenberg says that if the impact abrasion is particularly severe, thicker inserts can help. “Additional thickness of those wearable material inserts will help out in a lot of those situations.”

The bottom line is that the proper selection of component accessories, including the various configurations and alternative materials can provide the ultimate total system wear-life expectancy. However, by designing piping bends and elbows to withstand this high impact abrasive wear, a reduction in operating costs can be realized in the system.

“If you’ve got more of a critical system where you can’t afford any down time other than scheduled, then it’s worthwhile to spend the extra money for the appropriate abrasion resistant solutions,” says Wollenberg. **PI**

Ultra Tech Pipe,
www.ultratechpipe.com

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FutureMark Green Clean technology creates brighter recycled paper with far fewer chemicals

Alsip, IL-based FutureMark® Paper Company, which claims it is the only North American manufacturer capable of making up to 100% recycled coated paper for magazines and catalogs, has introduced two new products made with an innovative “Green Clean” process that delivers high brightness ratings for high-recycled paper while greatly reducing the use of chemicals used in paper production.

FutureMark says its Green Clean technology enables embedded inks to be extracted from waste paper more efficiently and effectively. It is projected to reduce the company’s use of de-inking chemicals, such as caustic soda and peroxide by up to 30%. FutureMark Green Clean technology will also enable the company to increase the percentage of post-con-

sumer waste (PCW) used in most of its recycled publication papers. FutureMark coated publication papers currently average more than 90% total recycled content and 30% PCW, which it says is the highest by far from any major North American producer.

By combining Green Clean technology with modifications to its manufacturing process and product formulation, FutureMark Paper achieved a remarkable 85-brightness rating for its two new products: Future Choice® 85 Matte publication paper and Future ReMark® 85 label paper.

“Creativity, not chemicals, drove this quality boost,” said FutureMark president and CEO Steve Silver. “We’re proud to have attained this exceptional level of brightness in our recycled papers without

resorting to harmful chlorine bleach or other harsh chemicals. We’re constantly looking for new ideas and technologies to enhance our products and operations. It’s this commitment to innovation that enables us to produce the highest-quality recycled paper in North America without compromising on environmental performance or cost.”

Future Choice 85 Matte coated publication paper and Future ReMark 85 C1S label paper are commercially available now. Data sheets are at <http://www.futuremarkpaper.com/products.html>. **PI**
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