

SPOTLIGHT ON TECHNOLOGY

EPS

vs.

P&O

Will this new mechanical blasting process challenge chemical pickling as a preferred method for preparing the surface of steel coils?

THE MATERIAL WORKS in Red Bud, Ill., has developed a new slurry blasting process that it claims offers a more environmentally friendly, and lower cost, alternative to conventional acid pickling of steel coils.

The new process was dubbed Eco Pickled Surface or EPS by its originator TMW President Kevin Voges. Though his company is primarily a toll processor, Voges has invested heavily in the design of new equipment to clean the surface of hot-rolled black steel.

His earlier effort, known as SCS, was largely successful as a replacement for hot-rolled black steel, but fell short of his ultimate goal of finding a true substitute for conventional pickling and oiling. SCS employs a wet brushing sys-

▣ The Material Works began commercial production of EPS material in mid-December 2008 after a year and a half of debugging this original alpha line at its facility in Red Bud, Ill. A second, higher-capacity beta line now under development is expected to achieve operating costs approximately 40 percent lower than the alpha line.



tem, which removes all but a micron-thin coating of scale from the steel's surface. This coating inhibits corrosion and allows the SCS material to be warehoused for long periods without adding oil, which must be removed later in the manufacturing process before the metal can be finished. Since its launch in 2003, TMW has licensed nine SCS lines in the U.S. and Europe, in addition to its own, which continue to produce the brushed material.


Where SCS ultimately fell short was in its use in deep draw stamping, continuous galvanizing and prepaint applications. Users found that when the SCS material was bent, the thin coating of scale could powder and cause problems with dies or coatings. For post-painted formed parts, SCS works well, Voges says.

"SCS remains viable for some people, especially fabricators. If you have a high degree of cut-to-length operations servicing a lot of lasers, SCS is great and economical. But if your customers do a lot of deep draw stamping, EPS is the answer," Voges says.

Recognizing that SCS would be limited in replacing pickled and oiled material, Voges and his staff—with the assistance of outside consulting engineers—sought a better alternative. Recounting the arduous trial-and-error process, Voges says he considered every conceivable technology to strip all the dirt and scale from the steel's surface—from ultrasonic waves to laser curtains to combination furnaces to waterjets to shot blasting. Ultimately, he found that a high-pressure slurry spray was the ideal method for stripping the steel clean without damaging or eroding the surface.

TMW's slurry blast technology combines a fine-particle metallic abrasive with a water carrier, which continually recirculates. The




 Housed in the blasting cells in the center of TMW's alpha line are fast rotating impellers that propel a slurry of water and abrasive metallic particles at a high velocity across the moving strip of coil, cleaning the steel of all dirt and scale. The EPS slurry used to blast the scale off hot-rolled coils includes carbon steel particles of irregular shape (inset) suspended in a recirculating mixture of water and a rust-inhibiting additive. As the particles break up and become rounded and dull from the impacts, the slurry is refreshed with new particles.

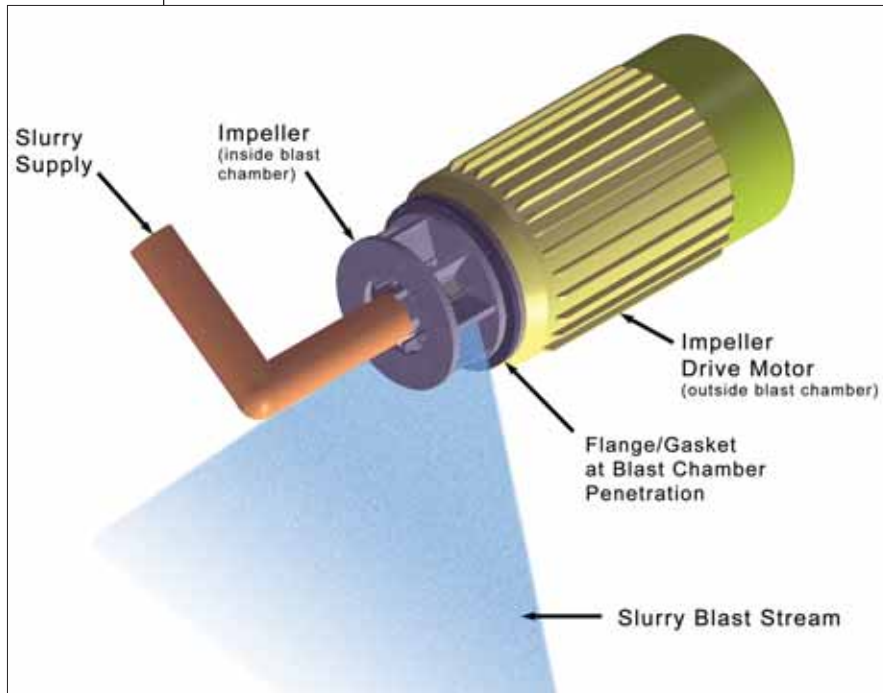
resulting slurry mix is fed into a rotating impeller that propels it at high velocity across the moving steel sheet. Twin centrifugal slurry blast heads provide coverage uniformly across a 72-inch-wide strip.

Finding the right abrasive grit proved to be a challenge. TMW originally tried a stainless steel grit for its inherent antirust characteristics, but it proved too expensive. Engineers finally settled on carbon steel particles of irregular shape, adding a cleaning agent to the carrier liquid to reduce smut and corrosion of the abrasive particles. As the particles break up and become rounded and dull from the impacts, the slurry is refreshed with new grit.

Experimentation proved that the slurry blasting process would remove all the scale, without taking any substrate, and that the process could be "tuned" by varying the abrasive velocity to achieve a rougher or smoother surface, as desired depending on the finish to be applied.

Discovering—largely by happenstance—that EPS material would not rust unless moisture was allowed to rest on the surface opened the door to a host of product advantages vs. pickled and oiled material, Voges claims.

EPS is rust inhibitive, but for a different reason than SCS, he explains. The EPS process leaves behind trace amounts of silicon,



chromium, magnesium and aluminum, all constituents of carbon steel. These trace elements react with oxygen in the atmosphere to form a protective film that inhibits corrosion. The process is much the same with stainless steel, though stainless contains much more chromium. The chemical reactions involved in acid pickling remove these trace elements from the surface of the steel strip, thus a comparable protective film cannot develop. Pickled steel will rust in a matter of hours if it is not given a protective coating of oil. Removing the oil later is a nuisance and an expense for the manufacturer or parts fabricator.

TMW, mills, service centers and end-use customers have performed substantial application testing of EPS-processed material, with universally positive results, Voges claims. Paint tests show that EPS panels consistently meet or exceed automotive OEM requirements. EPS coils have been shown to be fully interchangeable with acid-pickled coils for stamping, roll forming, laser and plasma cutting, punching and tube production. EPS coils also have been successfully cold reduced, annealed and galvanized, Voges adds.

Because the surface of EPS is oil free, it can be welded or laser cut faster while producing fewer fumes that workers



☛ This artist's rendering (top) shows the basic design of TMW's EPS slurry blast technology, which feeds metallic particles into a liquid carrier and uses a rotating impeller to create a high-velocity curtain of slurry that strips the coil clean enough to leave a white cloth unsoiled when wiped (above).

must breathe. In addition to improved paint adhesion and corrosion test results, EPS offers economies of material management, since users can stock EPS in place of both hot-rolled and P&O, Voges says.

After a year and a half of trial runs and debugging of its original alpha line, TMW began selling EPS processing commercially in mid-December 2008. A higher-capacity beta version of the EPS line now under development is expected to achieve operating costs approximately 40 percent lower than the alpha line. The beta line will employ two EPS cells—with eight blasters in each cell, four above the strip and four below—to improve the throughput.

Compared with EPS, pickling with hydrochloric acid has several disadvantages, Voges says. A pickling line comes with a high capital cost and has a large footprint, compared to the 100-foot length of an EPS tension leveling line. A pickling line has high operating costs including the energy to heat the acid and perform regeneration, the labor to operate the line, and disposal of scale and chemical byproducts. If a pickling line stops, it can stain and damage the steel strip. Overpickling of the strip can result in the loss of control in subsequent cold rolling.

EPS also offers a significant cost advantage over pickling, Voges claims. He estimates the current EPS cost at \$8 to \$11 per ton, depending on the width and thickness of the strip, vs. \$15 for conventional acid pickling. He projects that future EPS lines with additional refinements will approach a cost of just \$5 to \$6 per ton. The capital cost to install an EPS line is about half what it costs for a pickle line, he estimates.

Based on the number of pickling lines it could displace, and the number of coil-prep lines it could add to the market, Voges sees a potential market for at least 100 EPS lines in the U.S. and abroad. "I can see 10 to 12 systems here in the U.S. very easily. How do we get to 100? The interest is particularly strong in Europe and India, and there is strong interest among picklers to replace their acid tanks with EPS cells," Voges says.

Cost of a 30,000-ton-per-month EPS line that tension levels coils up to 74 inches wide by 3/8th-inch thick at a 75,000 psi yield will be roughly \$8.75 million, including the equipment and a licensing fee.

TMW has applied for multiple patents based on both the slurry blasting equipment it designed and on the new process that makes metal rust inhibitive.

Voges understands why potential users might be skeptical of his claims that this EPS dry steel product does not corrode. To reassure them, TMW offers a warranty of 180 days against rust damage.

While Voges claims EPS is steadily winning converts at a number of service centers and end-users, such a new and unfamiliar technology will undoubtedly take time to gain wide acceptance.

One early advocate of EPS material is Matt DeJong, vice president of manufacturing at DeJong Manufacturing in New Sharon, Iowa, a contract manufacturer and job shop primarily serving the agri-

culture and construction industries. The oil-free surface of EPS material is a major advantage for his company, he says.

“Not having oil keeps contaminants from our pretreat system before we paint. Not having oil creates less smoke in laser and plasma cutting. Not having oil helps in the welding process. Not having oil gives us a cleaner, healthier environment for our welders. That’s why we are kind of excited about it,” DeJong says.

His company has run three semi loads or about 75 tons of EPS through its plant so far, with good results. Powder coatings on parts have shown superior adhesion. Material stored for nine months in his warehouse, through various seasonal climate changes, showed no signs of corrosion, he says.

He’d like to use more EPS, and start to phase out some P&O, but that presents some logistical challenges. “We would like to use EPS exclusively, but the processors we source from today don’t have EPS lines. So by the time they

freight the coils out to TMW and pay for the EPS processing, then freight them back, we are at a dollar disadvantage. Until TMW installs more of these systems out there, we cannot do it cost-effectively,” DeJong says.

Steel Warehouse in South Bend, Ind., operates a conventional pickle line, but its Chairman and CEO Dave Lerman is keeping an eye on the progress of EPS. It’s too early to predict how EPS may affect the market, he says.

“The surface of the material looks good. The process might actually correct some surface defects that would otherwise show through in pickling. But it’s a little early to know how much it will cost to actually run a line like this over a long period of time. You have to get a bunch of it out there and really see the practicality,” he says.

“[Voges] is a creative guy who is trying to come up with new methods, and I give him credit for it,” Lerman adds. ■