Exporter introduces high-chrome mill liners to the local aftermarket

Abrasive wear lining specialist, Mitak, operates one of the largest dedicated high chrome white iron (HCWI) foundry in the world. *MechChem Africa* visits the proudly South African company's stand at Electra Mining Africa and talks to Graham Anderson, business development director, about its mill lining aftermarket offering.

Mitak operates one of the largest dedicated high chrome white iron (HCWI) foundries in the world.

"We have been in business for 45 years now and in all that time we have been sharply focused on the development and supply of cast high chrome white iron products for use in highly abrasive applications," begins Anderson.

"Starting with small impactors in the asbestos industry to replace the manganese that was more commonly used, we quickly branched out into the manufacture of other wear parts suitable for HCWI. Now, grinding parts, slurry and dredge pump spares and chute linings," are also now part of Mitak's high-value HCWI offering," says Anderson,

"HCWI typically contains between 17 to 28% chromium, but we tend to narrow that to between 22 and 25%, with carbon levels most commonly between 2% up to 4.5%" he explains, adding that this makes the material very hard – with Brinell hardness numbers typically above 600 BHN.

"When compared to harder ceramics, HCWI offers improved impact resistance while retaining excellent hardness from the embedded carbides. This combination makes it a surprisingly versatile material in many high-stress mining applications – including mill linings. What's more, it offers superior wear resistance to rubber in many applications. This is particularly the case with sharp, angular ore types that tend to cut the rubber on low angles of attack," he adds.

Most high chrome white iron can only be air quenched in order to achieve the desired hardness and the wear resistant properties of the material.

"For many years in South Africa, we have been working with Welding Alloys South Africa, a market leader in weld overlay cladding technology, to improve its lining solutions. We developed and continue to supply a base casting to them, which is suitable for welding but, because it is a high chrome substrate, should the abrasive wear penetrate through the weld overlay layers, the component's structure is not quickly destroyed.

"While this is not new technology, it still has the potential to change the weld overlay market, because the harder and tougher substrate offers far better protection than can be achieved if cladding onto traditional steel castings," Anderson tells *MechChem Africa*.

The local mill liner offering

While work hardenable manganese steel is the preferred liner material for jaw and cone crushers, and large semi-autogenous (SAG) mills in South Africa tend to be cast in CrMo steel, Anderson says that fully autogenous grinding (FAG) mills as well as rod and small ball mills are ideal candidates for the installation of HCWI replacement liners.

"Even though we have made HCWI mill liners for many years, it has not been a major focus of ours and we have not really tackled the end-user mill liner market in any major way," Anderson continues. "In doing so now, we do not see ourselves competing with the OEMs, which are our main customers after all, but with aftermarket imports being brought into South Africa in massive volumes from China, Canada, USA, Indonesia and Malaysia," he notes.

"In the mines of Africa, CrMo liners are sometimes preferred for the fully autogenous mills. More and more operators are expected to begin taking the braver HCWI decision, though, because they have realised that a similar investment on high chrome mill linings may last at least twice as long," he points out.

Wear life goes up exponentially with hardness, so the high chrome at 600 BHN should outlast a CrMo liner at 350 BHN by more than an additional lifetime, although there are obviously other complications such as micro/macro wear, angle of attack and the specific wear mechanism that come into play when making a material selection decision.

The suitability has to do with the ores being milled, the geometry and configuration of the mill and the size of the grinding media. "Our objective is to replace the linings used on autogenous mills, which are designed to suit hard chrome, with our aftermarket HCWI solution – and Africa's copper mills are expected to be a very successful hunting ground for us. Our solution is also ideal for platinium and nickel ores and for many ferrochrome plants," Anderson suggests, adding that a significant number of secondary and tertiary mills are also are suitable candidates for high chrome.

"Currently, over 60% of the products we manufacture here in Alrode are exported. Yet we believe we can offer South African operators a far better value proposition. Our mill linings contain about 95% local content, being made from locally sourced scrap and locally mined ferrochrome – 85% of the world's ferrochrome reserves are estimated to be in South Africa or Zimbabwe. In addition, we are in a far better geographical position to service South African mill operators.

"And from a country perspective, our foundry is a value-adding beneficiation process for South African mined minerals, the only imported products we buy in being molybdenum and some of the ceramics we use in our MITAK IC (infiltrated ceramic) lining product developed for grinding the high-ash coal used at some of Eskom's plants," Anderson tells *MechChem Africa*.

The Alrode HCWI foundry: a global benchmark

Mitak's globally benchmarked Alrode foundry facility is among the most modern in the world. Being dedicated to high chrome alloys, the foundry processes adopted have been honed over many years to produce castings to the highest global quality standards in the most efficient and cost-effective way within minimum lead times.

"We have our multi-beam laser scanner on show today, just to give a sense of how modern and precise the foundry industry has become," Anderson informs *MechChem Africa*. "This system can measure the 3D dimensions of a mill liner to an extremely high accuracy in minutes.

"We originally bought the system as a quality inspection tool, to inspect the accuracy of finished castings. Essentially, it is ideal for use in producing aftermarket replacement liners for mills," he says.

Describing Mitak's production process, Anderson says that the traditional starting point is a set of CAD drawings of the mill lining system component. "Using our laser scanner, we can also create drawings directly from a customer's spare set of liners, though," he adds.

"The CAD model produced is then sent in two different directions. Our production engineers use the drawings to produce tool paths for our milling machines to enable them to make the necessary patterns. We have a 5×6×2 m CNC milling machine that can automatically produce timber patterns from the product tool path for making the sand moulds.

"We also have a large format 3D printer that can make accurate patterns for use as a direct substitute for timber patterns," he says.

At the same time as the pattern is being made, Mitak's casting process specialists use the drawings to model and optimise the flow of metal through the mould. "We use mould modelling software called Magmasoft, which enables us to design the runners, risers and flow channels in the mould to enable perfect filling and ideal solidification rates," he explains.

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As well as its renewed focus on mill liners for fully autogenous grinding (FAG) mills, Mitak routinely manufactures and supplies high-value HCWI grinding parts such as slurry and dredge pump spares and chute linings.

Once a pattern has been designed and made, a sand mould can be produced and production proceeds to the foundry. "We will first cast a prototype liner and we will again use the laser scanner to measure the accuracy of the lining for comparison against the CAD model or drawings," Anderson tells *MechChem Africa*.

"This processing loop enables a first prototype to be produced that is very close to the original drawings or to the reverse engineered digital model produced through laser scanning," he assures, adding that additional corrections or improvements can quickly be made to further improve the final outcome.

"We have a team of 25 pattern makers here in Alrode and, using our modern rapid prototyping and modelling capacities, our response rates and turnaround times are very high. We are one of the few foundries in the world to have adopted this technology to the extent we have.

"We believe that local autogenous mill operators have the most to gain by choosing our solutions in preference to importing, which involves greater risk and cost and significantly longer lead times," Anderson concludes. ❑