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Automotive Aluminum Casters Document Degassing Rotor Performance

While sparkling diamonds and glittering gold might be the first exports that come to mind when thinking about South Africa, those who track the automotive industry know that South Africa also is an important exporter of automobiles and automotive components. Exporting more than a quarter of a million vehicles to more than 70 countries, South Africa serves as a manufacturing center for all of the world's major automobile companies and eight of the world's top ten component makers.

This article explores how two South African aluminium casters serving the automotive industry are reducing their costs and enhancing metal quality by using advanced degassing rotors from Morgan Molten Metal Systems.

HUNTING FOR QUALITY

To protect their position in the global automotive industry, aluminum casters in South Africa must meet and exceed ever more demanding technical specifications for better quality and cleaner metal. Technologies able to remove impurities from the melt are becoming ever more important to the foundry and widespread within the industry. One of the most efficient and therefore most prevalent techniques employed by foundries is rotary degassing.

Metal quality in molten aluminium and aluminium alloys is largely determined by the presence of impurities, typically dissolved hydrogen and solid non-metallic inclusions. The dissolved hydrogen comes out of solution as the metal cools and forms unwanted porosity. This porosity, along with the non-metallic solid inclusions, reduces the strength and adversely affects the final properties of castings produced from the aluminium.

The rotary degassing technique removes these undesirable components by bubbling a gas, usually nitrogen, through the molten metal. This gas is normally introduced by means of a degassing rotor, which reduces the bubble size and disperses the nitrogen throughout the molten metal bath. As the resulting bubbles rise through the mass of molten metal, they absorb the hydrogen dissolved in the metal and remove it from the melt. In addition, the non-metallic solid particles are swept up to the surface to be removed by skimming.

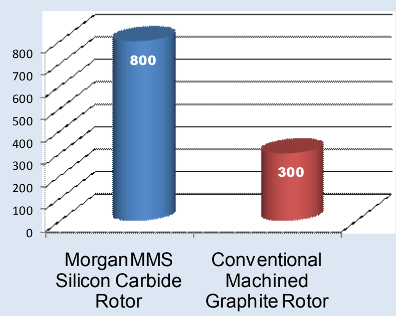
The MorganMMS silicon carbide rotor is isostatically formed as a single piece to resist erosion for a long and consistent service

DISCOVERING SUPERIOR DEGASSING PERFORMANCE

The **Hayes-Lemmerz** South Africa automotive aluminium alloy wheel plant switched to a MorganMMS silicon carbide degassing rotor after the performance of its machined and impregnated graphite degassing rotor proved less than satisfactory. Brendan Ferns, metallurgist at that facility, reported that with typical rotor speeds of 600 rpm at a cycle time of 240 seconds, degassing rotors at Hayes-Lemmerz were subject to challenging conditions. Impregnated graphite rotors were found to wear quickly and their degassing performance deteriorated as head geometry became distorted. Consequently, nitrogen gas dispersal suffered.

Ferns said that impregnated graphite rotors had to be replaced after about 300 cycles, even when flux additions were withheld. That equated to just 2-3 days of production. He reported that the MorganMMS rotors, however, were normally changed after 800 cycles, cycles that included 100 grams of flux additions. He noted that the flux treatments did not negatively affect the performance of the silicon carbide rotor.

Rotor Service Life in Degassing Cycles at Hayes-Lemmerz



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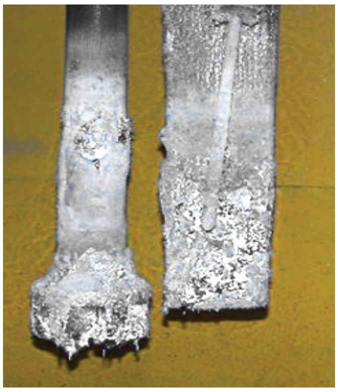
Hayes-Lemmerz (Continued)

Overall, Fern pointed to financial advantage accruing from less frequent rotor replacement and the higher level of production that could be achieved through less downtime.

Worn graphite rotor replaced after just 300 degasing cycles.



MorganMMS silicon carbide rotor in service at 761 cycles.

ASC Reports MorganMMS Degassing Rotors Avoid Shaft Failures

Aluminium Squeeze Casters (ASC), based in South Africa, a subsidiary of Pressure Die Casting Group, manufactures automotive parts using an aluminium alloy LM 24. Melting takes place in a 200 kW induction furnace with a 350 Kg (770 lbs.) yield. The melting process is designed to convert runners and overflows from the production facility into a liquid state within the specific alloy specification ready for production. During the preparation process, dross is removed from the molten aluminium charge and the charge is degassed with nitrogen to remove any hydrogen gas that maybe trapped within the liquid metal.

But ASC was experiencing wear degraded performance and frequent shaft failures of its machined graphite rotors. This led to unproductive downtime and unacceptable consumable costs. Its solution was replacing its machined graphite rotors with one-piece, isostatically pressed rotors made of a silicon carbide and graphite blend from Morgan Molten Metal Systems.

ASC reports that its new degassing rotor has completed in excess of 588 cycles (98 hours of actual degassing) during its first four months, which it noted was substantially longer than its previous rotors which failed early in their life cycles. "The cost savings in replacing probes has far exceeded our expectations," ASC concluded in its report.

Careful Operation, Maintenance Maximize Rotor Service Life

Proper care and maintenance is key maximizing the service life of a MorganMMS degassing rotor. ASC follows a rigid work procedure on a daily basis when using its degassing probe.

1. To prevent extreme temperature shocks, the degassing probe is preheated gradually for 5 minutes by placing the probe over the molten metal held at 850°C (1560°F).

2. Nitrogen gas is then allowed to flow through the probe at a rate of 15 l/min (4 gal.min) before it is submerged into the metal to prevent the channels within the probe from become blocked.
3. Once submerged, the degassing probe starts to rotate at 386 rpm to allow an even distribution of nitrogen gas.

4. When degassing is complete, the probe is removed while nitrogen continues to flow through it to ensure the channels remain clear and all excess aluminium is blown out.
5. Once the probe has slightly cooled, a wire brush is used to remove any excess aluminium or dross from the probe and then it is allowed to cool naturally.
6. Coatings are applied to the degassing probe on a regular basis to assist with the cleaning process as it helps prevent aluminium and dross from sticking to the probe and extends its life span.

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