A word from SEFPRO on furnace maintenance for optimal operations

With rising energy volatility and stricter emission regulations, furnace longevity is more vital than ever. SEFPRO CARE® offers innovative hot and cold repair solutions to help glassmakers maintain optimal furnace conditions. Here, offering his expert insights, SEFPRO CARE® & Expendables Product Manager Benjamin Hénout focuses on real-world cases to explain how furnace life and performance can be extended.

Against a backdrop that has market and energy prices becoming volatile, production facilities in the glass industry are capital intensive and require long investment cycles. Depending on the market, glass producers are now facing complex choices in energy sources: using current fossil fuels such as natural gas, oxy-gas, hydrogen and rounding it out with electrical boosting before making a transition to full electric furnaces. A side effect of reducing GHG emissions by electrical boosting is a higher corrosion rate of materials in contact with glass - especially in melting bath areas. Exposed to these trends, all of the glass industry (container, flat, specialty, insulation, reinforcement and display) is adapting its industrial strategy to optimize current furnaces and evaluating new furnace technologies to be used for the coming decades. This is precisely why SEFPRO CARE® has been developed: to propose complete repair solutions for hot & cold repairs for all glass makers, which provides our customers both flexibility and reliability in the management of their industrial assets. The purpose of this article is to give an overview of possibilities offered for hot and cold repairs, which are illustrated with two real case

scenarios with outcomes from the repair work done on regenerator chamber and container glass furnaces.

GLASS FURNACE HOT & COLD REPAIRS HOT BOTTOM AVAILABLE WITH AZS AND CHROM50

Until now, classical products for hot bottom repair exhibit several drawbacks such as limited flowability, strong surface roughness and open porosity, high curing temperature and limited capability to be drilled. SEFPRO CARE® has developed its unique solution to perform hot bottom repairs without these issues.

This patented composition provides an alternative to the use of AZS chips. With self-flow behaviour, a composition purely made of fused cast AZS grains, and a sintering stage starting at 1,000°C, our composition can be used in low temperature areas such as refiners and forehearths With only ten hours of curing time in the range of 1,200/1,300°C, the product sets during the installation process. This creates a high level of mechanical strength in the lower layers.

Thanks to these specific properties, furnace managers can shorten their repair time by having fast sintering after installation compared to traditional solutions. This time-savings can represent up to several days depending on the project size. Furthermore, it secures the furnace structure by avoiding a long, risky and costly specific heat up at 1,550°C for 72 hours to sinter as the other types of solutions based on zircon/alumina/mullite grains require. Considering the installation, or re-installation, of electrodes, our Hot Bottom AZS provides sufficient mechanical strength after sintering to be compatible with drilling operations to install or reinstall electrodes in addition to a relatively smooth surface with closed porosity that protects electrodes from corrosion. The two next products are monolithics that have been engineered to provide the glass makers a flexible solution to perform hot and cold repairs with a single type of application. An example is given for AZS grains obtained from fused cast, but different sets of premix and binders are to be selected depending on the furnace application and installation conditions.

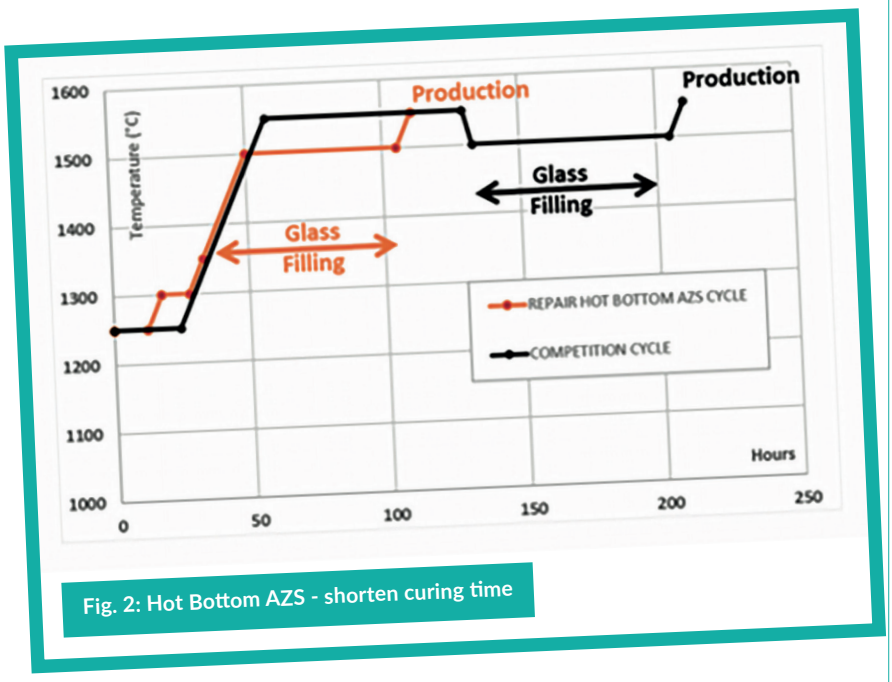

Fig. 2: Hot Bottom AZS - shorten curing time

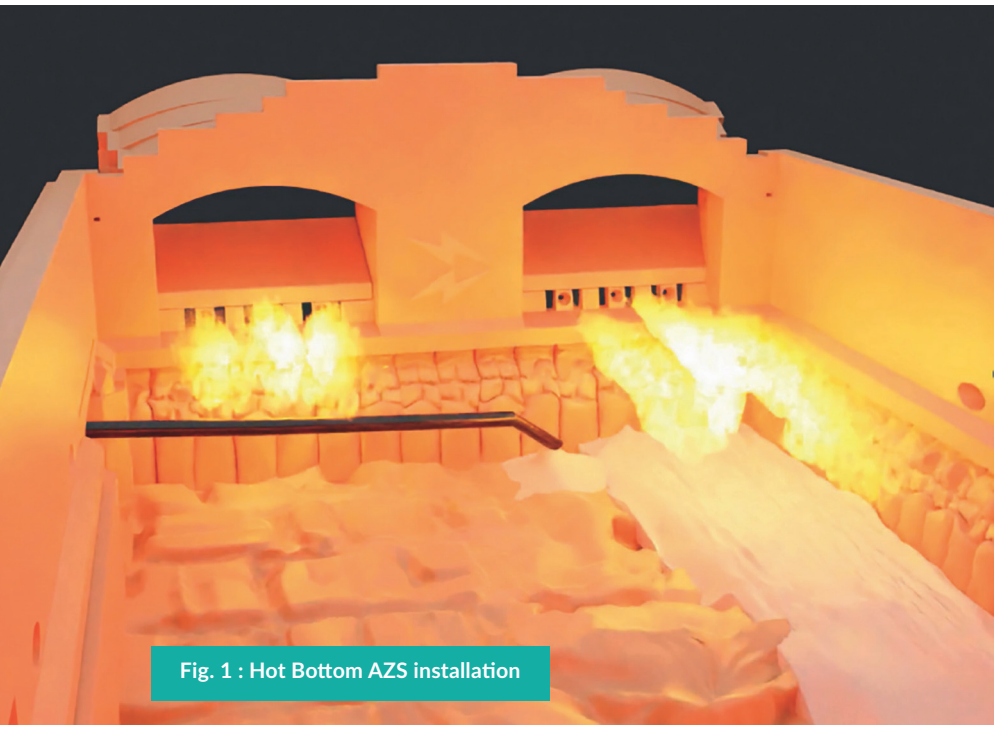
Fig. 1 : Hot Bottom AZS installation

HOT OVERCOAT AVAILABLE WITH AZS, CHROM50, FUSED SILICA AND ALUMINA

This product has been designed to propose a versatile castable solution for hot repairs

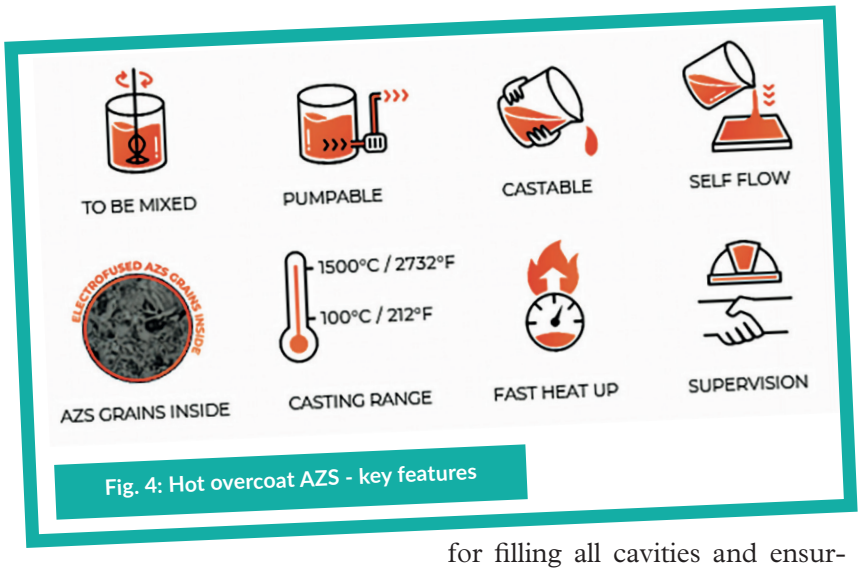

Fig. 4: Hot overcoat AZS - key features

of glass furnaces. Thanks to its special properties, it can be used in a very broad range of applications and gives the best results in terms of duration. We decided to use our best in class Fused Cast AZS grains to generate this monolithic solution. Thanks to a special packing in bags, our customers can decide to prepare batches from 125 kg up to several tons. Its application process is also very flexible as you can use it from a simple casting with buckets to a continuous feeding by double pistons pumping.

The product can take the required shape by using multiple types of forming methods. For example, wooden or metallic molds can both be used. Its self-flow property is a key strength for filling all cavities and ensuring a very good homogeneity in the final block after setting. Starting usage at 50°C all the way up to the highest furnace temperatures, Fused Cast AZS exhibits its best final properties at any temperature within this exceptional range. This product has been validated across a broad range of applications from glass contact overcoating to crowns or regenerators repairs.

CAST IN PACE AVAILABLE WITH AZS, CHROM50, FUSED SILICA AND ALUMINA

This product is the cold version of the one detailed previously. It exhibits the same properties in terms of rheology and casting functionality. The main difference is the application temperatures which should not exceed 35°C. The product sets in cold conditions and requires a 24-hour maturation period in its mould before release.

It is especially advantageous when weak areas are discovered during a cold stop of a glass furnace. Once casted, the product can be unmoulded 24 hours later. An additional curing time of 48 hours is optimal to allow the product to reach its full mechanical strength. Then the heat up process can begin according to the heat up curve specified in product data sheets or tailored to the specific case if the thickness of the CIP exceeds 250 mm. This product can be used to rebuild glass contact areas, superstructure, tuckstones, port necks and/or regenerator walls, whether partially or fully.

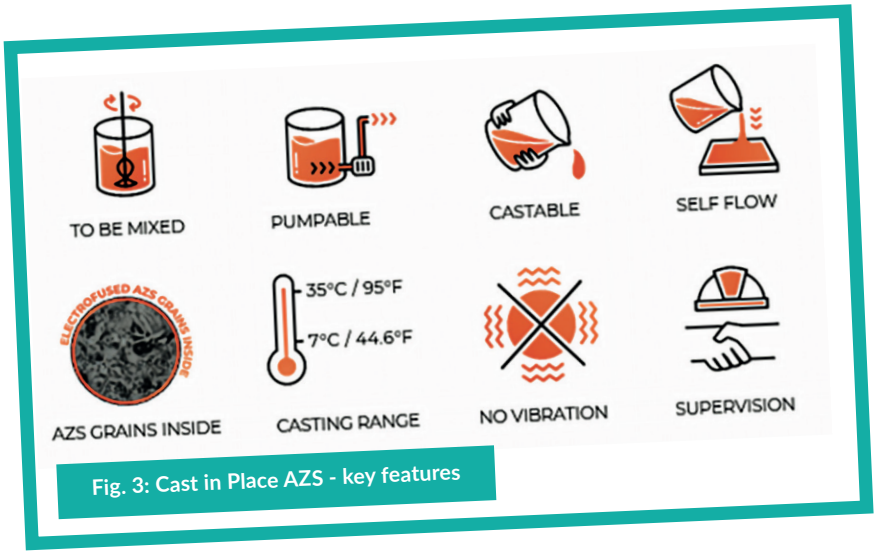

Fig. 3: Cast in Place AZS - key features

PATCHING TILES AVAILABLE WITH AZS, AZS LOW FIRED AND CHROM50 LOW FIRED

These electro-fused tiles are particularly suitable for overcoating tanks and can provide furnace lifetime extension around three or four years. They can be applied in a furnace with a broad range of temperatures from room temperature to 1,500°C. They exhibit premium corrosion resistance properties thanks to SEFPRO's manufacturing process to create void-free homogenous pieces.

The use of electro-fusion process, or fused cast grains for the low-fired version, provides the highest material compatibility with glass baths. Consequently, patching tiles are of interest as they avoid heat-up, maintain high corrosion resistance, are EHS friendly (no Cr6+), and are easy to recut on site. They are available in multiple thicknesses, and our supply chain ensures a per-

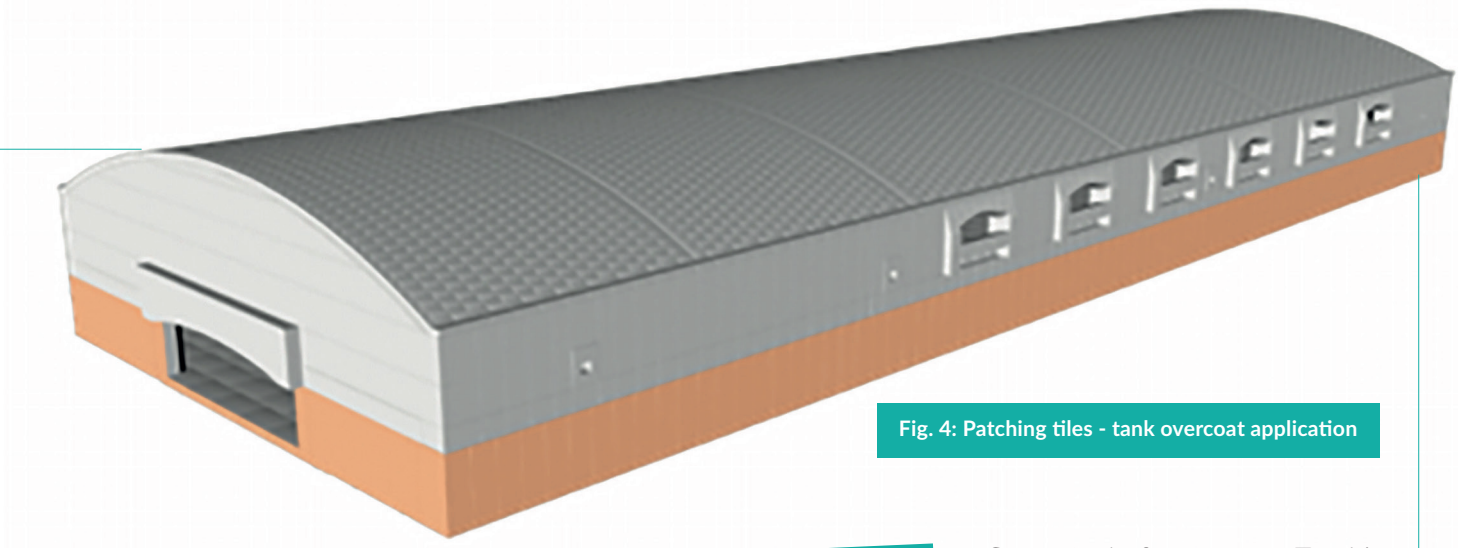

Fig. 4: Patching tiles - tank overcoat application

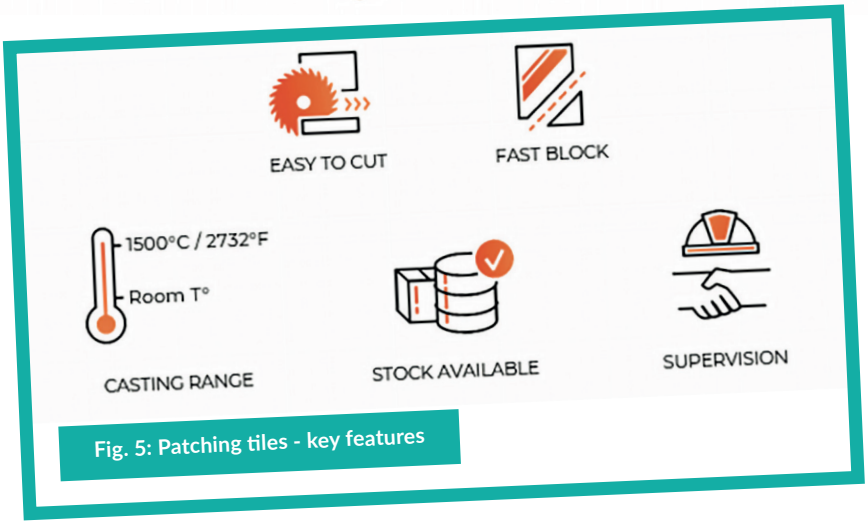

Fig. 5: Patching tiles - key features

manent stock to support urgent repairs with a delivery in less than two days.

SEALING WITH ZIRCON

SEFPRO's Zircon paste is dedicated to filling superstructure joints during hot operations or cracked blocks repair.

Initially provided as a pumpable and dust-free sealing solution, this jointing paste is now also available in ready-to-use applications, such as bucket or specific guns, for smaller repairs.

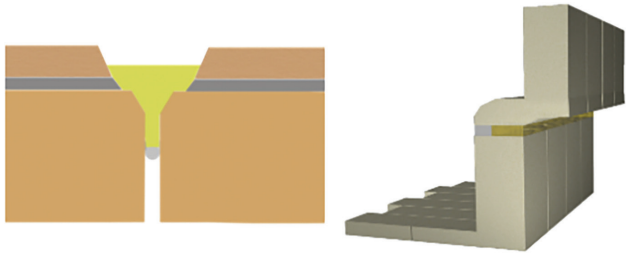

Fig. 6: Tank wall and crown jointing

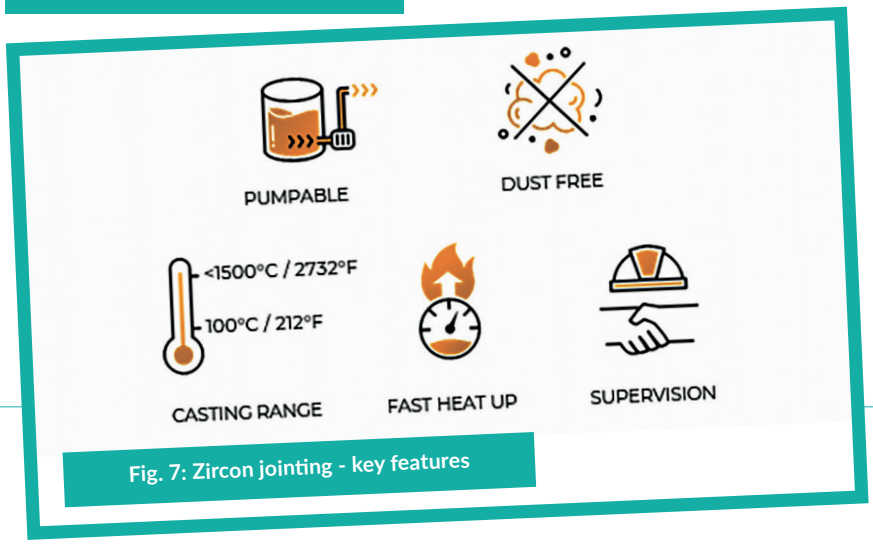

Fig. 7: Zircon jointing - key features

Composed of 63 percent Zr, this paste is easy to prepare and to apply, fills small cavities from 2 to 20 mm and requires no vibration.

OPERATING GAINS REGENERATOR WITH CHIMNEY BLOCK

Example of hot repair whilst keeping the furnace in operations in order to save one among the four regenerator chambers. A container glass furnace was powered with natural gas and furnace oil around 16 MW and was producing around 340 tons per day. The furnace was facing a collapse of the chimney blocks, impacting drastically the regenerator efficiency. Application of hot overcoat AZS within the chimney block was done to keep the regenerator chambers in working conditions and avoid further damages while running production.

Knowing that pre-heated air passing by regenerators provides approximately 25-30 percent of the total heat required for glass melting, estimated consumption savings from this repair is one MW that would have been powered from gas if the chimney block was not repaired. Translated into CO_2 emissions, had this furnace been operated without this hot repair then approx. 1825 tCO_2/year would have been emitted.

HOT BOTTOM AZS

As mentioned, classic products developed for hot bottom repairs exhibit several drawbacks such as

Fig. 8: Hot Overcoat - chimney block replacement

limited flowability, strong porosity, high curing temperature, and limited capability to be drilled. For such repairs, our Hot Bottom AZS composition can provide important energy savings thanks to lower sintering times and temperatures, and consequently a rapid return to production. Indeed, our composition made purely of fused cast AZS grains provides a sintering stage starting at 1,200°C and requires only around 10-20 hours of time to apply, when other hot bottom solutions provide a sintering stage starting above 1,500°C and require around 48 up to 72 hours for use.

When it comes to electrode boosted furnaces, our Hot Bottom AZS solution also provides a smooth surface with very limited porosity that protects electrodes from corrosion and prevents any future leakage in this sensitive area. Feedback from our latest repairs have confirmed efficient ramp-up after hot bottom AZS repair, especially within the quality target (no stones or bubbling were noticed after the glass filling period).

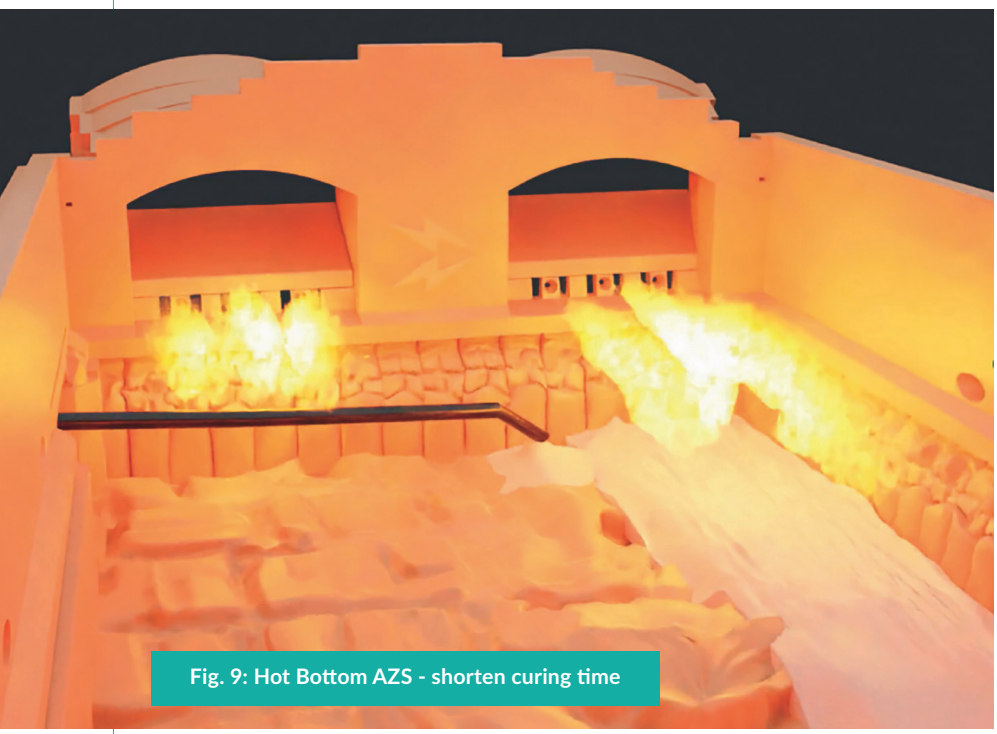

Fig. 9: Hot Bottom AZS - shorten curing time

IN SUM

In this current decade where the glass industry is facing external trends such as drop down of end-consumer consumption, energy price volatility, and regional legislation for GHG emissions, all glass makers need to adapt their industrial strategies to use their current furnace in the best way possible and to decide which furnace technology they will use for the coming two decades. This is why SEFPRO CARE® has developed and proposed solutions which have been validated and are demonstrating their superiority in various types of applications. From bottom to regenerators, from extrados to glass contact areas, there is always a solution to repair and extend your furnace lifetime without impacting the glass quality. ■

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