



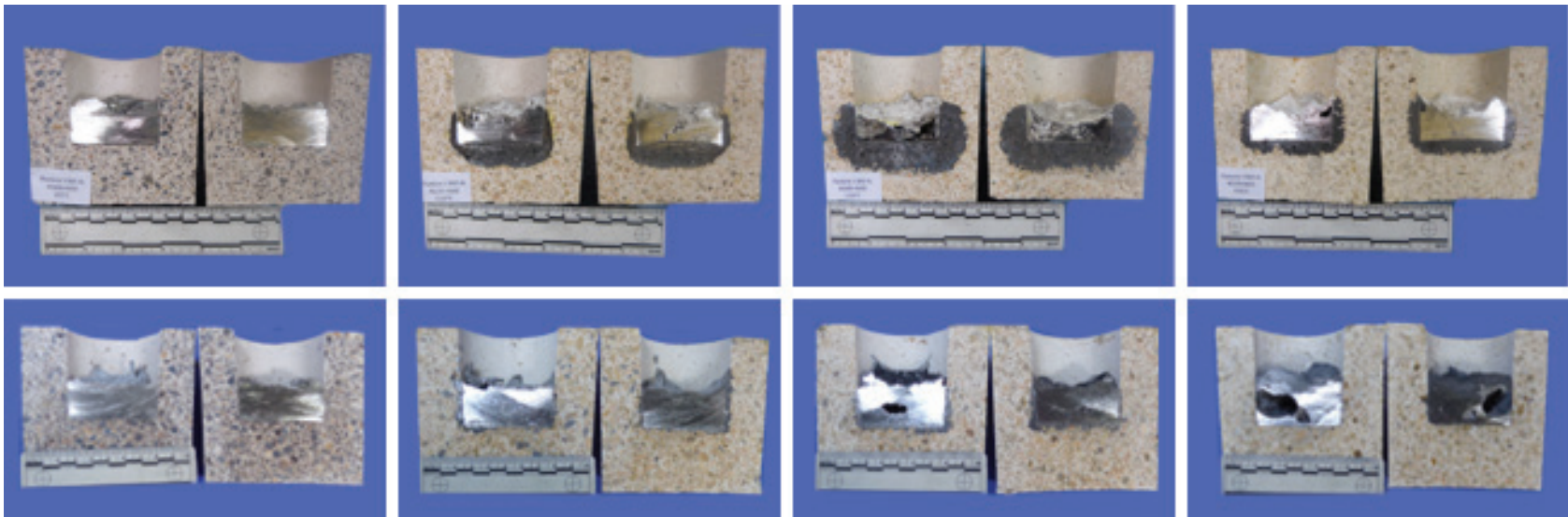
# EREDI SCABINI NEWS

Since 1945, the refractory specialist at your disposal.

## Alproof®: the new family of castables for the aluminium industry by Eredi Scabini.

With the hundreds of proprietary formulations (of our own invention!) in our catalogue, we believed that, over time, we had built up an offering broad enough to guarantee the best solution for all - or almost all - customers' needs in the aluminium industry. However, since it is not in our nature to “rest on our laurels”, observing the changes in the market we realised that we could do even more, and even better.

So, about 3 years ago, we launched a project to reassess our products specifically for aluminium, which involved the performance of more than 600 corrosion tests on 49 refractory castables, with four different alloys (46000/46100;5083;7075; 2196) at four different temperatures (815-1100-1200 and 1300°C). An analysis of the huge amount of data generated by the tests revealed that our offering guaranteed excellent coverage of both standard and heavy-duty applications, but from the commercial point of view it was less competitive in intermediate applications (e.g. reverberatory furnaces with medium-power regenerative burners). There was therefore a gap in our range for a more specific product for these applications, which would enable us to offer customers an alternative to our “high-end” products. Therefore, starting from an existing product family, which provided a well tried and tested base, our R&D department developed a new technology, capable of delivering better performances in terms of resistance to thermal shock and corrosion resistance at higher-than-standard temperatures. A better compromise, if possible at the same price as the existing refractory. This was no easy task: the alumina content was not to be increased in order to avoid higher reversible linear changes and lower thermal shock resistance, and the exclusive use of “non-wetting” additives in the matrices to reduce corrosion and provide better resistance to high temperatures had to be avoided. Without a doubt, efforts had to be concentrated on the matrix, which in these castables accounts for 40-50% of the total weight.



Daniele Scabini



Transition-plates coated with Becoat® WB 1000



The Becoat® range

## The Becoat® line grows and becomes even more efficient with Becoat® WB 1000.

The ever-increasing demands being placed on Aluminium components in areas such as weight reduction or higher mechanical strength have resulted in the need to develop more sophisticated alloys as well as reliable casting processes. Such developments require intelligent solutions – not just in terms of refractory materials, but also in their surface protection through the use of special coatings. Whether ingot casting or continuous casting, the Eredi Scabini range offers custom-designed solutions for every application – productive, reliable and efficient.

Becoat® is the Eredi Scabini's family of Boron Nitride coatings for the Aluminium industry. Becoat® products are aqueous suspensions with high concentration of Boron Nitride specifically developed for molten metal applications. Metals and ceramic materials coated with BEcoat® WB are easier to clean and last longer thanks to the excellent lubricating and non-wetting properties of Boron Nitride combined with special nano binders and additives. BEcoat® WB 1000, the last born, has been specifically developed for coating transition plates for Aluminium billets casting. The product can also be used in other applications in Aluminium, Zinc and Magnesium industries on ceramic materials in contact with molten metals to prevent corrosion and make the cleaning easier. In addition to the excellent lubricating and 'non-wetting' properties of Boron Nitride, special nano-additives provide good adhesion. BEcoat® WB 1000 is available concentrated -to be diluted- or ready to use and can be applied by spraying or paintbrush. Further information on the BEcoat® full range is available on our website.

Once again nanotechnology, which we have already been using for more than 15 years, came to our aid. The combination of techniques and knowledge of chemistry and physics which enables to manipulate matter at the atomic level to create structures with size measured in nanometres enabled us to add neutral, solid nanoparticles to the matrix, to block the pathways in the matrix by means of which the molten metals usually saturate the refractory, thus making it “aluminium-proof”.

These particles have immense specific coverage: just one gram of material is able to cover an area of 800m<sup>2</sup>. Since the number of particles needed to obtain our required result is minimal and our production know-how allows them to be evenly distributed even through large masses, their effect on the final cost of the product is negligible. This technique has provided the basis of new products with protection against corrosion and corundum penetration at high-temperature up to 90% higher than the equivalent standard product. Corrosion resistance is so high and the quality-price ratio so excellent that we have decided to create a whole family of these products: Alproof®. The following is the comparison between the corrosion resistance of Alproof® and the equivalent standard product. Alproof® compared to standard products at different temperatures. As the data show, in normal conditions (at 815°C) both products give excellent results, but from 1100°C to 1200°C there is 90% less corrosion on Alproof®. However, our regular customers should note that its physical properties and installation procedures are very similar to those of the well-established Flustone® products. We expect that this new, beneficial discovery will prove very popular with our customers!

## Eredi Scabini inaugurates its new “Advanced Technologies Center”.

Eredi Scabini reasserts its pioneering spirit by creating the Advanced Technologies Center (ATC), a new company division entirely dedicated to the research and development of new products and technologies, as well as the design of constantly more innovative, high-performing refractory linings. With state-of-the-art equipment, the new ATC has been built next door to the headquarters to house professionals with vast experience, including engineers, chemists and designers, who interact and collaborate every day, on an organised basis, to create products and services of excellence. The new ATC's existence is grounded in the concept - strongly rooted in the company's mentality - that no two projects are alike, and so every project deserves to be developed with the aid of all the know-how and resources available to the company; in other words, not research for its own sake, but as a means to achieve the aims set on the basis of the customer's specific requirements. The ATC is the place the company also likes to define as the “Home of Ideas”, because it brings together the important - not to say fundamental - branch of the company in which every new project is born, under a single roof. But the ATC is also the function that interfaces with the company's production side and sales function to oversee projects throughout

their whole lives, monitoring their progress and ensuring that every step takes place in accordance with the set aims. By creating the ATC, Eredi Scabini intends to consolidate its position as segment leader and to offer the refractory market products and services with high value added. This is a real mission, rooted in the firm intention to build an increasingly close relationship with its customers, based on the offering of exclusive products and services which are more and more specific and deliver higher and higher performances. The ATC is the jewel in crown of Eredi Scabini, which will be proud to offer a guided tour to all those interested.



The new Advanced Technologies Center and CEO Daniele Scabini

### Highlights

Alproof®: the new family of castables for the aluminium industry by Eredi Scabini.  
Eredi Scabini inaugurates its new “Advanced Technologies Center”.  
The Becoat® line grows and becomes even more efficient with Becoat® WB 1000.

PAGE 1

### case histories

ECO SIL + Flustone®: an unbeatable pair for coreless induction furnaces.  
The large aggregate revolution for V.O.D. cover.  
Longer lasting EBT lining with Flustone® SP.  
Eredi Scabini delivers record-breaking ladle lid lifetime: 5 years (+500%).

PAGE 2

A mix of products and methods for tower furnaces applied by true specialists.  
With RESISTONE™ the slag pit of electric arc furnace lasts at least 3 times as long.  
More resistant, longer-lasting launders for copper with Flustone®.  
Hydrogen pick-up in low pressure furnaces? We have the solution!

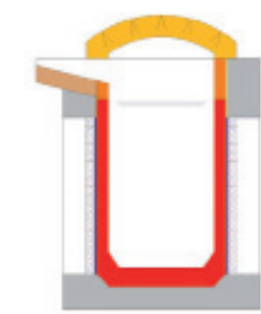
PAGE 3

Engineering+specific products = Exponential improvement in Upper Case + Inductor Performance!  
Alpur lining? You can count on Eredi Scabini!  
Refractory materials: permanent and reversible linear changes, considerations.

PAGE 4



## ECO SIL™+ Flustone®: an unbeatable pair for coreless induction furnaces!



Eredi Scabini promotes the use of LD (Low Dust) dry ramming mixes for a healthier working environment. All products are premixed with the exact quantity of binder, which is in anhydrous form to avoid releasing moisture to the furnace and reduces the porosity of the refractory lining.

The customer is an iron foundry producing about 60,000 tons per year of ductile and austempered iron castings for the earth-moving equipment market. The foundry has three 28-ton coreless induction furnaces, a 6-ton pressure-pour ladle supplying a casting line, and 6 treatment ladles with different capacities. Both the furnaces and the ladles are lined with Eredi Scabini materials.

A special solution was designed for the lining of the coreless induction furnace with the aim of increasing its lifetime by limiting its wear and resolving the problems that generally occur during operation. These include wall thinning, cracking caused by thermal shock and breaks when loading the material to melt.

The solution designed and installed by Eredi Scabini to meet the customer's needs involved the construction of a permanent lining in castable Flustone® X FINE, the installation of a slip plane in ECO-CLOTH® and a wear lining in ECO-SIL® LD, a high-purity Silica ramming mix. This material is formulated to maintain a loose backup to prevent metal infiltrations. Furthermore, the ECO-SIL® LD dry ramming mix has a special grain size distribution to guarantee high installation density, while the high purity level of the raw material guarantees excellent thermal shock and chemical resistance (photo 1). Last but not least, ECO-SIL® LD is a very easy-to-use product as it is pre-mixed and ready for use.

Using the Eredi Scabini solution, the lifetimes of the coreless induction furnace linings were increased considerably, for as long as 18 months in operation, with very few lining repair operations (photo 2).

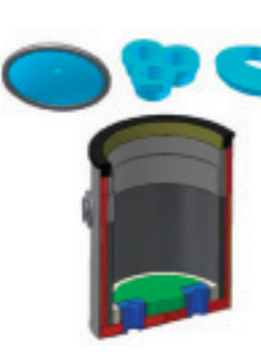


Eredi Scabini solution: furnace in operation after 12 months (photo 1)



Eredi Scabini solution: lining with wear repair after 18 months (photo 2)

## The large aggregate revolution for V.O.D. cover.



MEGABLOCK® is the outcome of Eredi Scabini's more than twenty years experience in the production of preformed refractory materials. The equipment used for producing, drying and firing these products is the best today's market has to offer. Strict control during the various production stages guarantees excellent quality standards. The use of an exceptionally large aggregate makes this a dense preformed shape with excellent resistance to thermal shock, abrasion and impact, and outstanding resistance to chemical attack by molten ferrous and non-ferrous metals and their slags.

The customer is a European electric steelworks specialised in the production of special alloy ingots. The 250,000 tons produced annually are forged within the group for the railway and energy market. The steelworks has a 70-ton electric arc furnace, a V.O.D. system and two ladle furnaces.

In the past, the customer used for V.O.D. cover a competitor's preformed shape made from low-cement high-alumina castable with aggregate size of no more than 10mm, which did not deliver the required performance. The lining lifetime was always too short, never exceeding 150 heats, with no guarantee that the preformed would survive to the end of the V.O.D. treatment (photo 1). Usually, the hole would enlarge, forcing the customer to make frequent replacements.

The adoption of the Eredi Scabini solution with the use of a microionic-set, dense large aggregate preformed shape, proved to be a revolutionary step for the customer. Using the electro fused alumina-based MEGABLOCK® preformed shape with added chromium oxide, the customer achieved an impressive improvement in performance: more than 270 heats (+ 80%), slower, more gradual preformed shape wear and completion of the V.O.D. treatment in all cases. What's more, the Eredi Scabini solution drastically reduced the number of replacements required (photo 2).

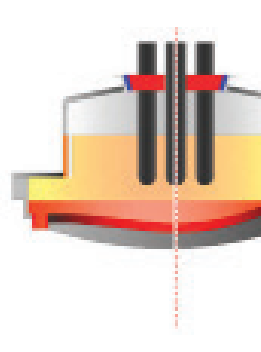


Conventional Solution: competitor preformed shape after 150 heats (photo 1)



Eredi Scabini solution: large aggregate preformed shape after about 270 heats (photo 2)

## Longer lasting EBT lining with Flustone® SP.



Flustone® is a line of microionic dense castables with excellent flow ability allowing application by self-distribution. They are used mainly for working linings requiring high resistance to abrasion and/or saturation by metals and/or slags. They are self-bonding, allowing linings to be repaired by applying the same product to the worn surface without changing the whole lining.

The client is a steelworks belonging to one of the European market's top producers of concrete rebars, wire rod and electrowelded mesh. The steelworks uses an electric arc furnace for treatment of the molten steel in the ladle followed by a continuous casting plant for the production of billets, which also supply the nearby rolling mill. During steel production, the electric arc furnace periodically requires hot lining repair of the EBT.

The steelworks needed to find a lining castable suitable for this operation, more durable than the one used in the past. It needed greater resistance to thermal shock, wear from the molten steel, and chemical attack from the sucked-in slag, especially when emptying the furnace.

Considering the customer's requirements, Eredi Scabini offered Flustone® SP, a microionic setting dense castable with excellent fluidity which allows self-distribution. It contains extra-pure Synthetic Spinel with excellent corrosion resistance, high mechanical strength and good thermal shock resistance. This high quality product, specifically developed for steelworks maintains its essential fluidity during lining of the red-hot EBT partly due to its self-distributing properties, facilitating the operators' work during installation and speeding up the repair job on the furnace. What is more, the product's hot bonding to the existing worn nozzles is also maintained during the furnace's duty cycle with no peeling.

After the first repair, this customer immediately noticed and appreciated the strength of the liner's bond to the substrate and the reduction in the number of repairs necessary, which proved to be one every 55 – 60 taps, using just 150 kg of material. Furthermore, the customer found that FLUSTONE® SP maintains the uniformity and diameter of the EBT hole much better over time, minimising the entrainment of primary slag into the ladle. (This slag is very rich in oxygen, causing a lower ferralloy yield, the need to add more of these materials during correction of the steel outside the furnace and, last but not least, more aggression towards and wear of the refractory lining on the ladle slag trap.)

REF. N.58



EBT awaiting repair

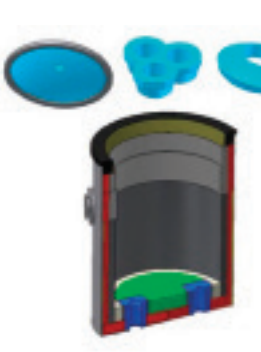


EBT after 10 heats  
After repair with FLUSTONE® SP



EBT relined with FLUSTONE® SP at end of cycle

## Eredi Scabini delivers record-breaking ladle lid lifetime: 5 years (+500%).



CAST LITE™ is a line of micro-porous insulating and super-insulating castables for installation by rodding or self-distribution. Developed for applications up to 1,700°C on both hot face and second face, they are an excellent alternative to insulating bricks and ceramic fibres. Compared to ceramic fibres, in addition to their greater mechanical strength and lower thermal conductivity, there are also no restrictions on their use arising from environmental and occupational health and safety considerations. Specific products have been developed for use in direct contact with molten metals.

The customer is an electric steelworks with output of about 900,000 tons per year of steel, which is processed in-house to serve the petrochemical, energy and automotive markets. The plant is equipped with a 100 ton electric arc furnace, two vacuum degassing systems and two ladle furnaces, using 100 ton ladles. The customer used to line the ladle preheating lids with ceramic fibres, aware of the relative environmental problems, the countless limitations on use at high temperatures and the risk of tearing due to the run-off burrs on the lip rings of the ladles themselves (photo 1). The customer was forced to repair the torn fibre parts quite frequently, replacing the entire lining after just 12 months service. Moreover, during operation the metal structures were stressed and deformed because the fibre no longer provided the necessary insulation due to the continual compression and tearing.

Eredi Scabini designed and produced a specific solution that lined the lid with environment-friendly CAST-LITE™ insulating castable, with density of 1 kg/dm3 and a maximum temperature of use of 1,600 °C combined with excellent mechanical strength (photo 2). The rim, on the other hand, was constructed using a Flustone® product, a refractory castable with high mechanical strength and thermal shock resistance, to increase the resistance to run-off bur formation on the ladle lip rings and thus avoid the deformation of the metal structures. With the Eredi Scabini solution, the customer managed to eliminate all repairs and to extend the lid's lifetime to over 5 years in service (+500%).

Today all the lid linings in the steelworks are still in good condition.

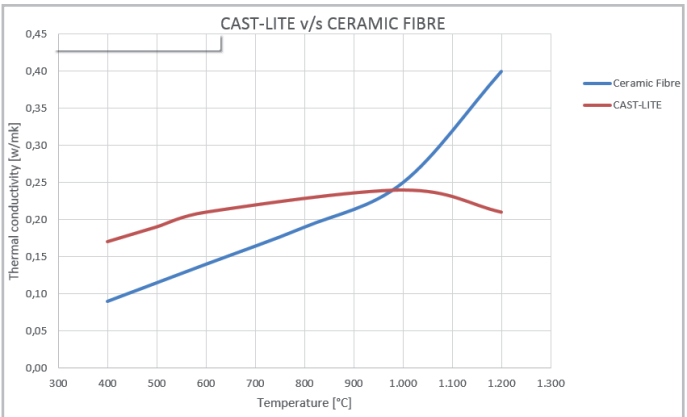
REF. N.59



Ceramic fiber lid after 6 months of use (photo 1)

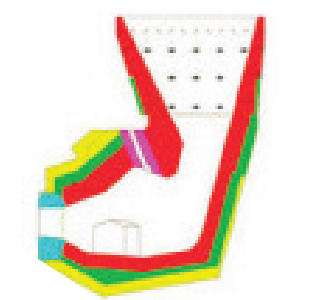


Eredi Scabini Solution: lid after 12 months (photo 2)





A mix of products and methods for tower furnaces applied by true specialists.



The company has offered and conducted the in-house development of top quality monolithic refractories since its foundation. The range now comprises hundreds of different formulae, used for the realisation of refractory and insulating linings as required by the characteristics of the project and the customer's specific needs, also using a wide variety of methods. In this case, the preferred option was the Flustone® line, which comprises a vast range of microionic setting dense castables used mainly for the realisation of linings requiring high resistance to abrasion and/or corrosion by metals and/or slag. The Flustone® line is self-bonding, allowing linings to be repaired by applying the same product to the worn surface without changing the whole lining.

The customer is a multinational specialising in the production of aluminium castings, mainly for the automotive industry. The aluminium ingots are melted with high-productivity tower melting furnaces. One of the production units has a melting capacity of 8,000 kg/h, provided by three tower furnaces. The customer's first experience of Eredi Scabini refractories dates back to 2009, during extraordinary maintenance of the melting chamber required to repair erosion of the refractory on the side walls, and to reconstruct the crown, damaged by impact during charging. On this occasion - especially for the crown, subject to mechanical impact from the charge and thermal stresses from the burner flames - a Flustone® range product was used. The solution, designed and then produced by Eredi Scabini for this plant's melting chambers, involved the use of specific products chosen to suit the characteristics and needs of the chamber's different areas/zones. The product chosen for the hearth, back wall and the crown impacted by the charge was Flustone® X AL, a self-distributing concrete with excellent mechanical impact and thermal shock resistance, as well as outstanding non-wetting properties even at high temperatures.

Flustone® X AL was also used for the walls of the loading hopper and on the slagging door sill, reinforced with special steel fibres to increase mechanical and thermal shock resistance. For the burner area, where the use of a non-wetting product would have been counter-productive, a Flustone® product with excellent thermal shock resistance was selected. In 2017 the furnace's entire refractory lining was reconstructed, including the holding chamber, using specific products to suit the different zones.

The furnace hearth and walls were lined with Flustone® V AL, a castable for installation by vibration, with high mechanical strength and excellent non-wetting properties, while the product chosen for the crown was Flustone® V, a castable for installation by vibration with good mechanical and thermal shock resistance and low thermal conductivity. The Flustone® used in the melting chamber burner zone was also used in the burner zone of the holding chamber.



Reconstructed melting chamber



Loading hopper after 12 months

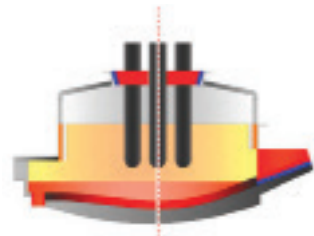


Furnace in operation

Thanks to this careful selection of varying products for the different areas of the furnace, maintenance of some parts - such as the crown subject to impact from the charge and the walls of the loading hopper and melting chamber - was reduced compared to competitor solutions. In particular, Flustone® X AL continues to give excellent results in the areas exposed to the most intensive mechanical and thermal stresses. Last but not lest, slag removal from the walls of the furnace is less problematical.

REF. N.60

With Resistone™ the slag pit of electric arc furnace lasts at least 3 times as long.



As well as its large range of refractory castables and preformed shapes, the company has a line of products specifically developed for industrial floorings subjected to extreme mechanical and chemical stresses combined with heat: RESISTONE™. RESISTONE™ products are installed by procedures similar to those used for construction concretes, but develop extremely high mechanical strength within just a few hours and can be used up to 1,400°C, even in contact with metal and slag splashes. Its rapid installation and ease of use also make RESISTONE™ excellent for maintenance purposes.

The customer is a European electric steelworks specialising in the production of special alloy ingots. The 250,000 tons produced annually are forged within the group for the railway and energy market. The steelworks contains a 70-ton electric arc furnace, a V.O.D. station and two ladle furnaces. The customer used to line the walls of the slag pit with construction concrete and metal plates. The lining's lifetime was very short, to the point where the entire surface had to be completely replaced every 6 months (photo 1), during all scheduled production stoppages. At the same time, the structures of the metal plates were modified by the heat, and they lost their fixing power. The customer complained of numerous problems and was also aware of the difficult conditions endured by the workers assigned to clean out the slag pit.



Conventional Solution.  
Construction concrete wall after 6 months (photo 1)



Eredi Scabini Solution  
New installation and wall after 12 months in operation (photo 2)

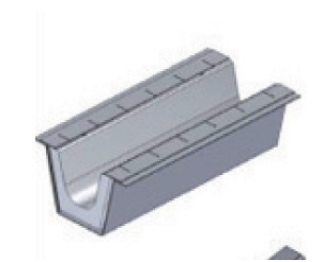
Eredi Scabini came up with a solution using specific products for the different parts of the slag pit, to ensure the best possible performance in relation to each area's specific problems.

The bottom of the wall, subjected to thermal shock due to contact with the slag and mechanical stress from the machine used to remove it, was lined with RESISTONE™ HT MF, a castable with excellent mechanical strength and thermal shock and abrasion resistance. The upper section of the wall, subject to high temperatures from the slag, was lined with RESISTONE™ ST, a castable with good mechanical and thermal shock resistance (photo 2).

Thanks to the Eredi Scabini solution, the customer has no longer had to completely reconstruct the linings every six months; since then, maintenance work has been limited to a few partial repairs at two-year intervals. For the customer, this has meant considerable reductions in maintenance costs and the major benefit of a slag pit operational at all times.

REF. N.62

More resistant, longer-lasting launders for copper with Flustone®.



Flustone® is a line of microionic setting dense castables with excellent fluidity allowing application by self-distribution. These products are used mainly for the realisation of linings requiring high resistance to abrasion and/or corrosion by metal parts and/or slag. They are self-bonding, allowing linings to be repaired by applying the same product to the worn surface without changing the whole lining.

The customer is a leading European producer of copper wire rod. With a production capacity of over 400,000 tons/year, 2 production locations, and more than 60 years' experience, the company is an industry benchmark. In the initial phases of contact with the customer, Eredi Scabini was asked to supply a castable suitable for lining the molten copper launders. Linings were required for section 1, immediately downstream of the shaft furnace tap hole and leading to the holding furnace, subject to the heaviest level of wear and thermal stresses, and section 2, downstream of the holding chamber to the tundish. The aim of the trial was to test and assess a material with multiple properties of mechanical resistance to the thermal shock and wear caused by the flow of hot copper, which was versatile and with a good quality/price ratio, and would allow the customer to keep in stock just one product for realisation of the wear linings of all its equipment, thus also simplifying stock management and the work of the refractory lining team.



Sector of launder no. 5 "section 1", 6 months, after easy cleaning



"Section 2" tank, after 6 months in operation, awaiting cleaning



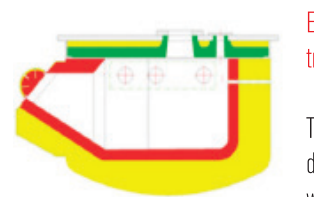
"Section 2" tank launder and Pool Pot in operation

Eredi Scabini suggested a Flustone® line product, a corundum-based microionic setting self-distributing castable with good mechanical and thermal shock strength and excellent non-wetting properties. Thanks its specific characteristics, the product is consolidated, well known and very popular in the red metal sector. When the product was tested on all parts of the line, the customer was immediately very impressed with its resistance, and over time an increase in durability of about 50% was noted in even the most heavily stressed areas, which could be repaired by simple filling after cold cleaning operations increasing the launder lifetime up to 120,000 tons of transited copper. The easy installation and easy management also found favour with the refractories manager and workers.

In view of these initial results, the customer went on to choose Eredi Scabini for other, more and more complex projects, culminating with the construction of the copper blocks of the charging mouth with FLEXTRONG® composite, the complete lining of the shaft furnace with the innovative ABT (Advanced Block Technology) system and, in the near future, the complete reconstruction of the holding furnace.

REF. N.63

Hydrogen pick-up in low pressure furnaces? We have the solution!



Eredi Scabini has acquired specific expertise in the lining of low pressure furnaces for Aluminium casting. The combination of specific products, installation techniques and heat treatments creates easy-clean refractory linings with high insulation and no hydrogen gassing and bubbling problems.

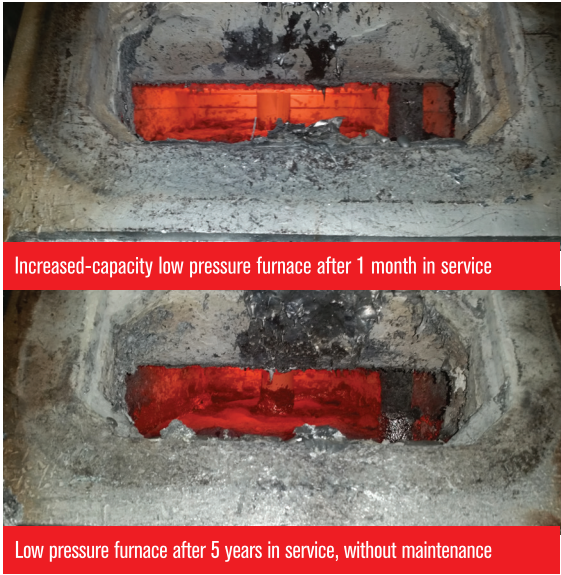
The Customer is the world's leading wheel manufacturer, with more than 20 plants, and supplies the top automotive constructors with choice quality steel and aluminium wheels, developed and produced with state-of-the-art technologies. One plant specialising in the production of aluminium wheels for high-end automotive manufacturers produces 1.4 million wheels a year. The production process starts in the foundry, where aluminium melting centres supply the low pressure furnaces which cast the wheel, prior to subsequent machining.

This first phase is crucial for guaranteeing a high quality standard and minimising reject rates from the outset.

Needing to reconstruct several low pressure furnace linings and aware of Eredi Scabini's high degree of specialisation in this sector, the Customer requested a lining which would withstand Aluminium attack over time while being easy to clean and well insulated and also delivering energy saving during holding and minimising the start-up times required to achieve the optimal aluminium density through immunity to hydrogen gassing. An increase in capacity was also requested, to help to raise productivity by reducing the number of furnace depressurisation and pressurisation cycles further to ladle charging.

After examining the request, Eredi Scabini focused strongly on the problem of hydrogen gassing, the main cause of reject pieces and reduced productivity, identifying the best products and most appropriate application procedures and studying the heat treatments to be performed on the refractory lining to eliminate the humidity which would potentially lead to hydrogen pick-up. For the wear lining, the product proposed for the tank was FLUSTONE®, combining resistance to chemical attack by the aluminium with mechanical resistance, with CAST LITE® for the lid. The insulating lining was constructed in PATCH LITE® and ISOLINE® MICROPOR microporous panels, which guaranteed extremely effective insulation and thus allowed the thicknesses to be reduced to increase capacity by about 90Kg of Al. The customer immediately noticed with great satisfaction that when the furnace was new the correct aluminium density was achieved in 2/4 shifts, when previously it might take as much as a week or more. Moreover, the hydrogen bubbling and gassing problems, even during production stoppages, quickly disappeared.

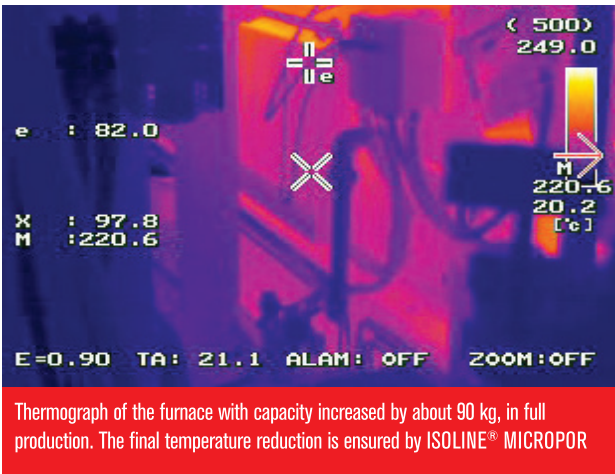
5 years after handover of the first furnace, and with no maintenance, the low metal structure temperatures, easy cleaning and genuine increase in productivity thanks to the larger quantities of aluminium available mean that the linings are still all in excellent condition and that the reconstruction programme is still running.



Increased-capacity low pressure furnace after 1 month in service

Low pressure furnace after 5 years in service, without maintenance

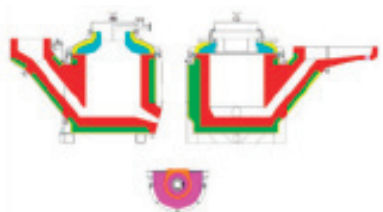
REF. N. 64



Thermograph of the furnace with capacity increased by about 90 kg, in full production. The final temperature reduction is ensured by ISOLINE® MICROPOR



Engineering+specific products = Exponential improvement in Upper Case + Inductor Performance!



Eredi Scabini specialises in the supply of engineering, products and services for iron foundries. The combination of state-of-the-art products and specific expertise delivers outstanding performances in terms of durability and energy saving.

The customer is a foundry which produces grey and ductile cast iron for the boiler and radiator market. The foundry is equipped with 2 cupolas and a pressurised induction furnace with capacity of 15 tons, which supplies a moulding line. Both the uppercase and the inductor of this furnace are lined with Eredi Scabini refractories.

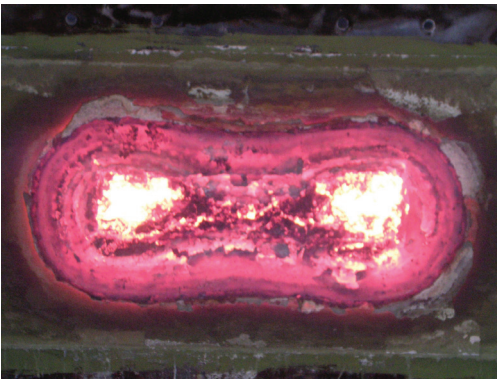
The uppercase lining was designed to guarantee minimal heat loss and maximum lifetime. The insulating and safety lining was constructed with two different microporous insulating castables from the PATCH-LITE® line, which in addition to excellent mechanical strength and very low heat conductivity are also free environmental and occupational health and safety restrictions on their use. The wear lining was constructed using DYSTONE® a large aggregate castable with excellent thermal shock and impact resistance, guaranteeing a very long working lifetime (photo 1).



Eredi Scabini Solution - Upper case after 5 years in service (photo 1)



Eredi Scabini Solution - Inductor lining (photo 2)



Eredi Scabini Solution - Inductor after 24 months in service

With the Eredi Scabini solution, the customer replaced the uppercase lining after about seven years in operation, achieving perfect coupling with the inductor right to the very last operating cycle. The inductor lining is designed to ensure insulation and wear resistance appropriate for the stresses and shocks it has to withstand during operation.

The insulating layer consists of ISOLINE® MICROPOR line microporous vacuum panels, which guarantee impressive temperature reduction, while the wear lining was constructed with a DRISTONE® line product consisting of electro-melted Magnesite and Spinel, ensuring excellent mechanical and corrosion resistance (photo 2).

The inductor lining's lifetime was extended to about 24 months in operation. Without a doubt, one of the factors behind this impressive result was the perfect mating between throat and inductor.

REF. N.65

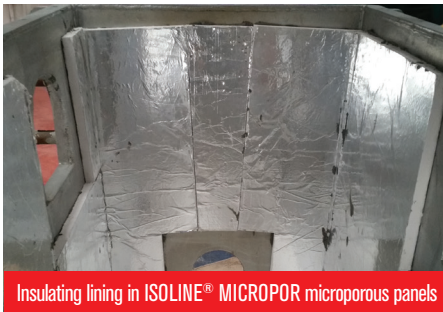
Alpur lining? You can count on Eredi Scabini!

Eredi Scabini, which has been active on the international refractories market for more than 70 years, has built up its reputation by working to constant high standards, tackling every new project with great care and a critical eye and bringing all its resources/expertise to bear to guarantee the optimal solution every time. This still flourishing, growing company has become a major benchmark in the aluminium industry and beyond. All of which simply encourages it to constantly do more and better.

The customer is a leading Middle Eastern company which produces rolled aluminium products with continuous casting machinery. Production capacity is about 250,000 tonnes/year in two plants. Rolled aluminium products are produced on 5 continuous casting lines of different sizes and capacities. An Alpur degassing unit is installed between the holding furnaces and the continuous casting machine, connected by launders. Since the customer was familiar with the high quality level of the products supplied by Eredi Scabini, and encouraged by the chance to work with a trustworthy partner



Alpur degassing unit in Ultrablock®



Insulating lining in ISOLINE® MICROPOR microporous panels



2Lite® insulating foam

of proven experience (more than 70 years in business), which was also highly specialised in preformed shapes, it decided to place an order with the company for the design and installation supervision of 3 units with two different geometry. The turnkey Eredi Scabini project included the construction of the working lining in Ultrablock® preformed shape made from fused silica and Silicon Carbide, with excellent resistance to the thermal shocks and abrasion caused by the liquid metal. It also comprised the insulating lining, made from ISOLINE® MICROPOR microporous panels, and the use of 2lite® nanostructured insulating mix which expanded once in place to generate a foam with extremely low thermal conductivity and high mechanic strength. Installation of the 3 units, by the customer with supervision from a specialist Eredi Scabini engineer, was successfully completed in just 1.5 days and did not require any special equipment.

REF. N.66

Papers

Refractory materials: permanent and reversible linear changes, considerations.

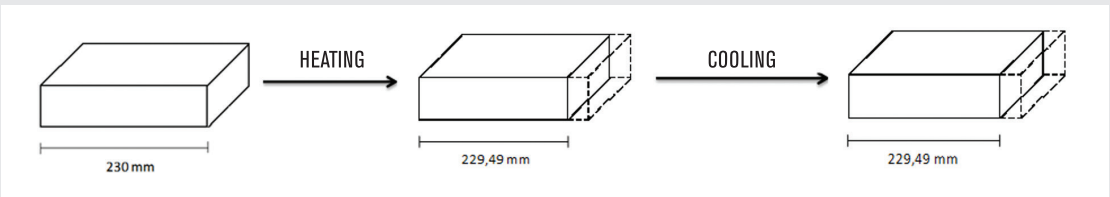
Under the effect of temperature, every body, whether liquid, solid or gas, increases or decreases in volume, and this change may be permanent or reversible.

Water, for example, freezes at temperatures below 0 °C and increases in volume; it also increases in volume when heated above 0 °C. Both phenomena are reversible, since the water will return to its original volume unless some of it has been lost through evaporation or vaporisation.

All refractory materials, both dense and lightweight and starting from non-uniform mixtures with varying water content, undergo two specific types of volume change based essentially on their linear changes:

PLC = Permanent Linear Change  
RLC = Reversible Linear Change

PLC is the linear change in a refractory body the first time it is heated. It may be positive (the body expands and then normally shrinks when cooled, but not to its original size) or negative (the body shrinks and this shrinkage is retained when it cools).



RLC is the positive linear change in the volume of a body that occurs cyclically whenever it is heated and cooled.

For example, a refractory preformed shape 100 mm long may have a PLC of -0.1% when heated to 1200 °C and an RLC of +0.5% at the same temperature. This means that when this refractory body is heated to 1200 °C the second time, its effective linear change will be +0.4% (-0.1+0.5=+0.4%)

This figure is crucial for calculating expansion joints and for establishing the exact size of preform shapes in relation to the heat treatments they will undergo prior to delivery to the end customer.

For example, if a preformed shape with a length of 1000 mm is produced from a castable with PLC -0.5% at 600 °C and this is the temperature at which it will be treated, for it to be delivered to the end customer with its design dimensions a mould 1005 mm long must be designed.

Another example: if we have a wall operating at 1000 °C and 3000 mm long, constructed with a castable with PLC and RLC which, at that temperature, are -0.3% and + 0.7% respectively, expansion joints must be calculated totalling 12 mm (-0.3+0.7= +0.4% of 3000 mm = 12 mm)

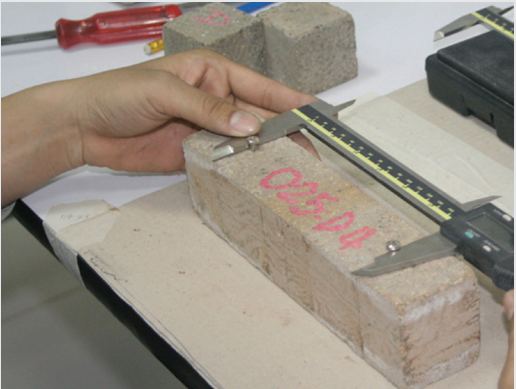
The calculation for bricks or preformed shapes that have already been heat-treated is fairly easy, since it does not matter what they have been made from or how; the situation is much more complex for castables installed on site. These materials may have a water content varying from 3%w to 40%w. This water can be free or chemically bonded, meaning that it must be eliminated in a temperature range from 100 °C to 800 °C.

The quantity of water present the first time the installed material is heated influences the heating speed and uniformity, and it thus indirectly affects the PLC values. Moreover, since in linings of this kind it is impossible to obtain the same temperature on the inside and outside surfaces, the relative PLC values will be different. The same applies to the RLC, and this generates stress inside the lining body, which in some cases may lead to hazardous and even inexplicable situations. Hence the importance of secondary layers capable of evening the temperature throughout the lining body.

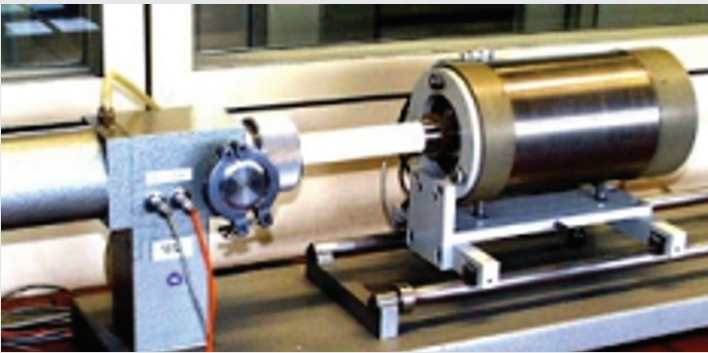
To a large extent the PLC depends on the type of castable used. The RLC is much more uniform, in that, regardless of the mineral base (bauxite, corundum, etc.), all materials containing 80% Al2O3, will have similar RLC values. This can be of considerable assistance to the design engineer if the specific RLC value for a given product is not available, but he does have that of other products with similar alumina content.

A material's PLC is established at room temperature in the laboratory, measuring the length of a sample bar before and after its first heat treatment at a specific temperature for a specific period of time (ISO 1927-6 and ASTM C113-02).

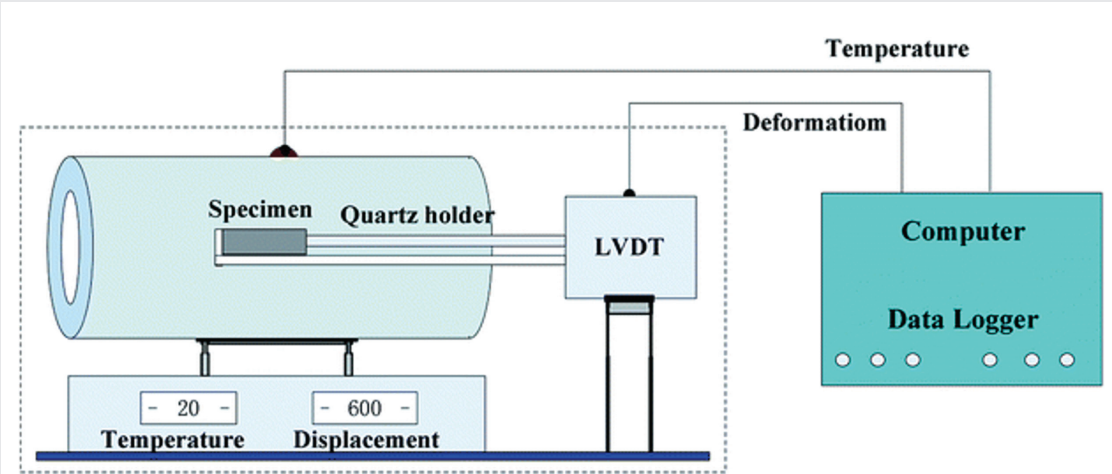
A material's RLC is established by measuring the change in length of a cylindrical sample already fired at a given temperature as it is heated and cooled evenly with a constant gradient.



The RLC is constant throughout the refractory body's lifetime barring extraordinary events (saturation, cracking, breakages leaving gaps, or chemical and structural changes).



The higher the RLC and the more discontinuous the operation of the equipment, the greater the stress on the refractory body, leading to spalling, breakage and loss of pieces. In practice, this refractory body will not withstand changes in temperature.



Written by Daniele Scabini