

SEFPRO

BRIGHTER SOLUTIONS TOGETHER



SEFPRO CARE®

How to maintain your glass furnace in best operating conditions ?

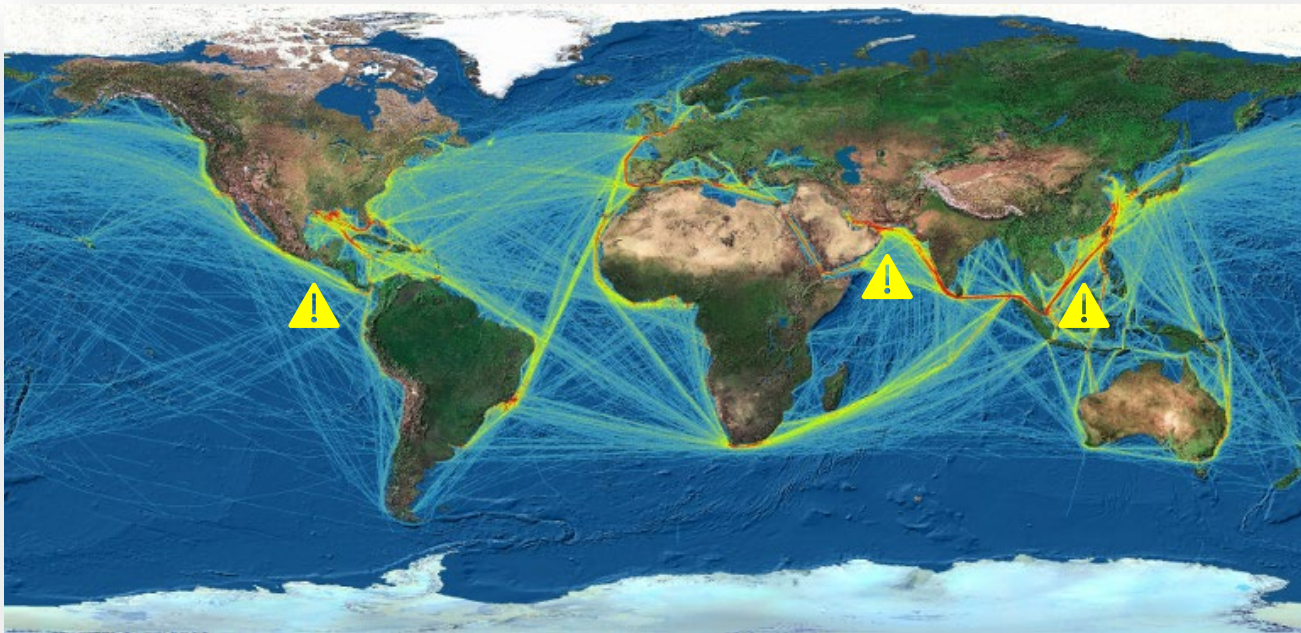
Benjamin Hérout - PhD

Product Manager - Care & Expendables

Glassman Europe 2025



2020- 2025 GEOPOLITICS PUT GLOBALISATION AT RISKS



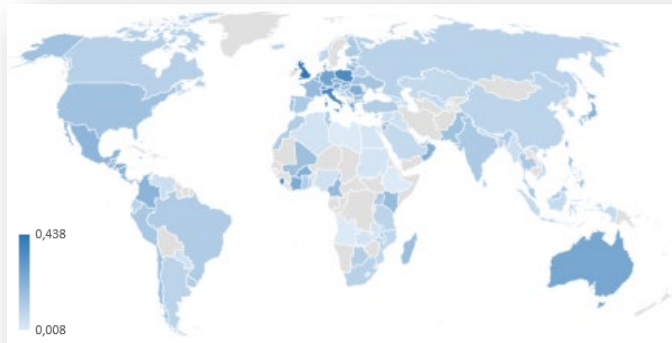
External factors

- **Increased stress on shipment road**
- **Global** glass producers face necessity to balance part of their production from an area to another one
- **Local** glass producers face risk to be isolated and are dependent of local/regional end-consumer behavior
- **Industrial assets of glass industry are not appropriate to manage stop & go as seen during the last 5 years**

**Risk management will impact board decision
to deploy and operate industrial assets**

PRICE DISPERSION OF NATURAL GAS AND ELECTRICITY

Electricity prices for the industry – USD/kWh



Natural Gas prices for the industry – USD/kWh



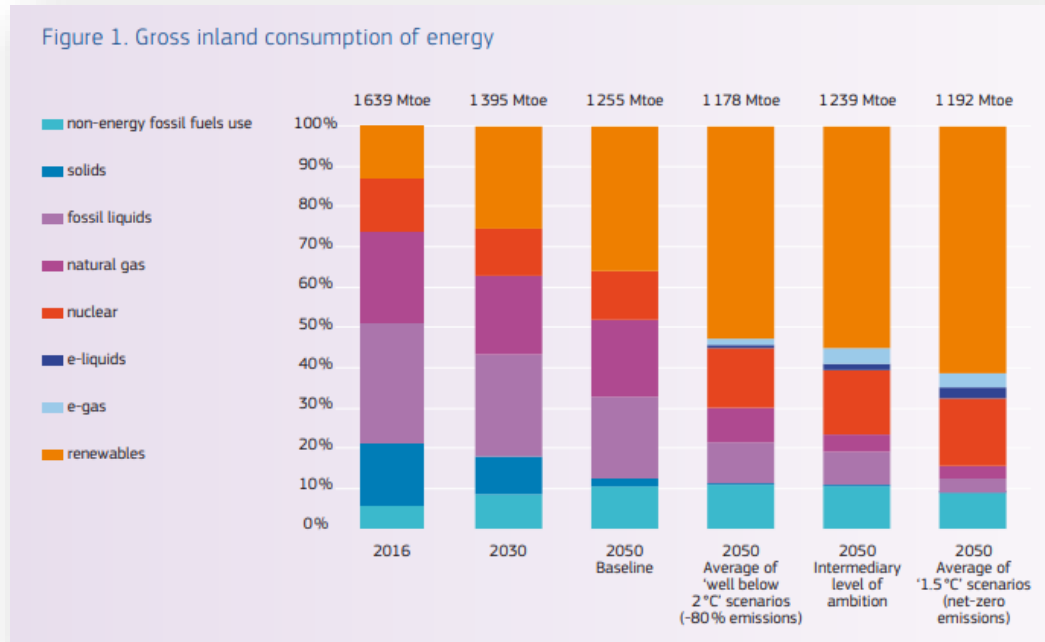
www.globalpetrolprices.com

Energy prices volatility

- Production facilities are capital intensive and require long investment cycles, while market and energy price have become volatile
- Glass producers face complex choices in selecting energy sources :
 - natural gas / oxy-gas / hydrogen
 - electrical boosting / full electric

In a stretched economy, the market needs solutions to secure extension of furnace operation and to get time for CAPEX optimization and decision

EU-27 ENVIRONMENTAL POLICIES



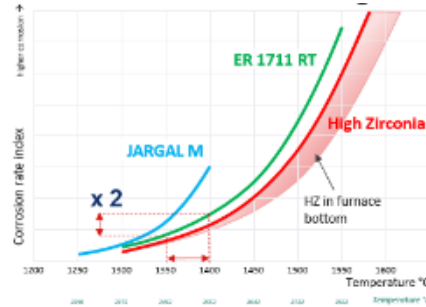
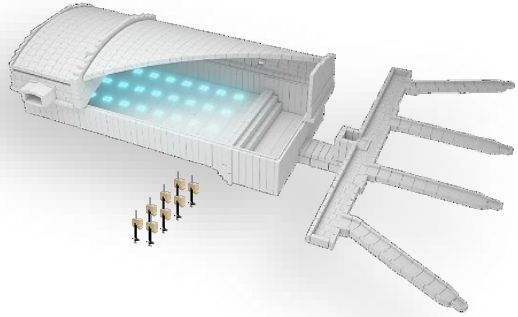
European Commission: Directorate-General for Climate Action, Going climate-neutral by 2050
A strategic long-term vision for a prosperous, modern, competitive and climate-neutral EU economy,
Publications Office, 2019,
<https://data.europa.eu/doi/10.2834/02074>

Horizon 2050 - Industry electrification

- Reducing Scope1 emissions by using 100% electric energy is causing increased corrosion
- SEFPRO CARE provide solutions to secure your furnace lifetime and further reduce your Scope1 emissions by enhancing yield and elevating glass quality

**SEFPRO is engaged on glass industry decarbonation
(refractories for e-boosted furnaces, high performance regenerators, material circularity)**

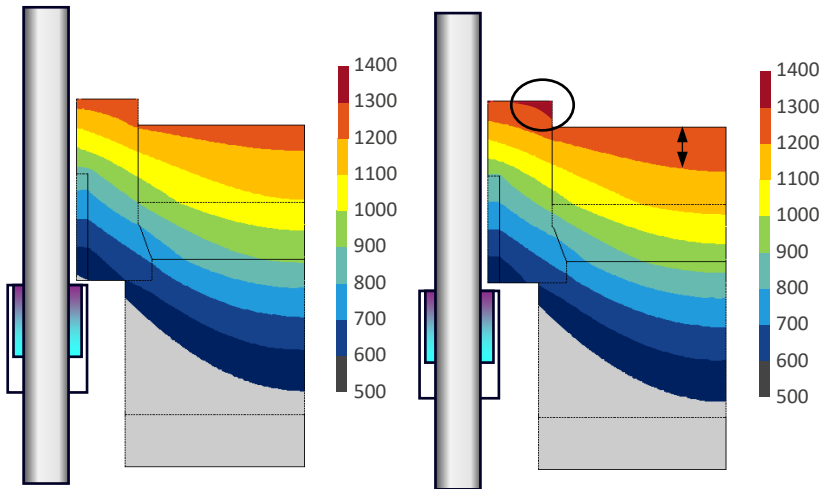
ELECTRICAL BOOSTING IMPACT ON SODALIME FURNACE



Increased electrical boosting leads to

- Higher bottom temperature
- Higher convection flow
- Faster corrosion of AZS
- Decrease of glass electrical resistivity

Bottom paving temperature rises by +50°C /+ 60°C



Low electrical boosting 10%

High electrical boosting 30-60%

**Maintenance will evolve
in case of e-boosted furnaces**

**SEFPRO offers full range of services
to design and anticipate repair**

LIFE CYCLE SOLUTIONS FOR GLASS FURNACES



We are continuously **supporting you** throughout your current furnace's lifetime and further – recycling and your future furnace.

Our goal is to propose solutions to improve your overall glass furnace performance and **help you reach glass decarbonization production.**





Your dedicated partner for your glass furnace repairs

In hot or cold repairs, with shaped or unshaped products, there is always a solution to extend your glass furnace lifetime



SEFPRO Care help you to **maximize your furnace lifetime** and **performance** with our premium range of **fused cast grains** for both **hot** and **cold** repairs.

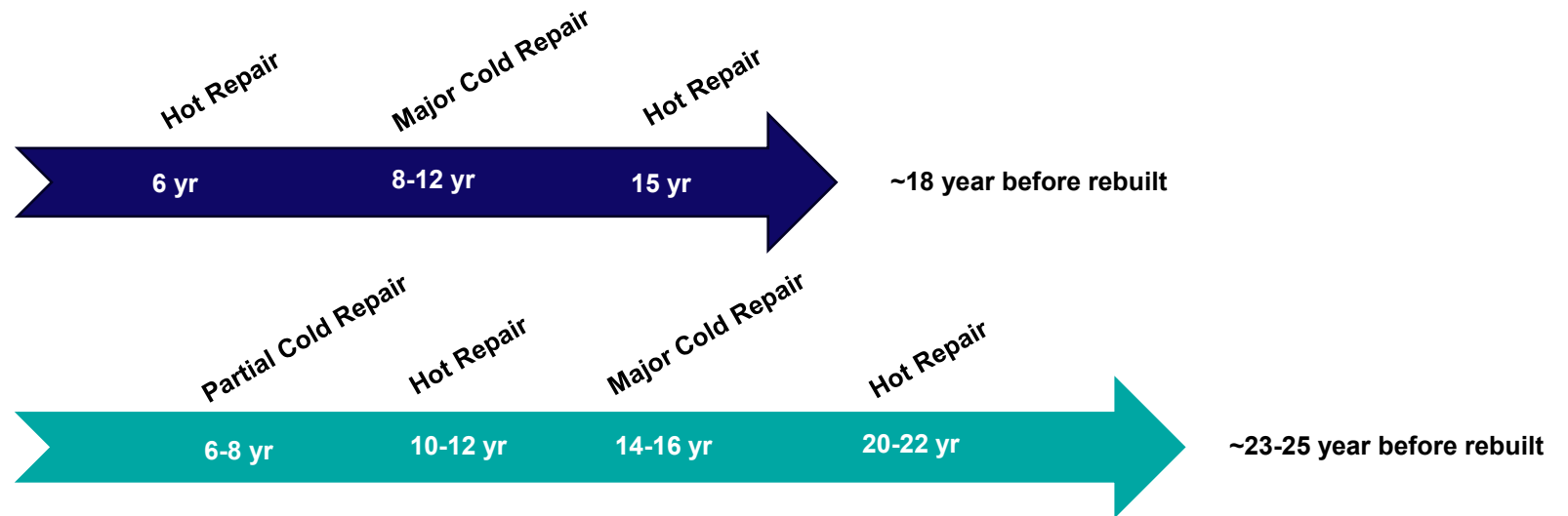
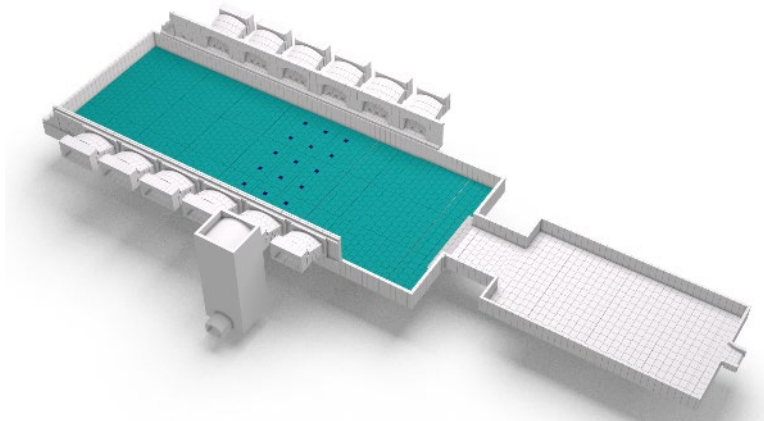
Thanks to our **technical expertise** with our **installation partner**, we help you to select the **optimum repair strategy** according to your needs.



Market volatility and energetic public policies imposes adaptability in CAPEX management

Different strategies are observed to extend furnace lifetime while optimizing CAPEX flow :

- 1 single major cold stop + some hot repair
- 1 anticipated partial cold stop + 1 major cold stop + some hot repairs



SEFPRO CARE brings adaptability in industrial strategies thanks to casting, hot bottom, overcoating, patching and sealing solutions

SEFPRO CARE ® | HOT AND PARTIAL COLD REPAIRS



SEFPRO Care to support you in maintenance or emergency repairs, giving you flexibility in your industrial strategy (CAPEX)

Furnace
Lifetime

Start-up

Urgent (hot) & maintenance repairs (hot or cold)

Major / minor
cold stop

Full
Rebuilt



Hot repair

Hot repair to **keep furnace in operation**
(high demand or industrial assets rigidity)

Partial cold repair

- Uncertain market conditions / furnace technology changes
- Partial replacement of fused cast blocks with concrete
- **4-5 years furnace lifetime extension** (major cold stops or rebuilds postponements)
- **Cost efficient repair** (CAPEX management)

Hot solutions

Cold solutions

Hot Bottom AZS

Hot checkerpack AZS

Hot Overcoating

Patching tiles

Cast In Place



- Pumpable self-flow concrete made of AZS fused cast grains
- Quick return to full production
- Lifetime extension: + 4-5 year
- Alternative solution: gravel AZS

- Partial repair of checkers – alternative to chimney block replacement
- Metallic molds filled concrete made of fused cast grains

- Versatile self-flow concrete based on fused cast AZS grains for hot repairs of furnace tanks, superstructure and crowns.

- From premium quality tiles (TJ) to repair tiles, to low fired tiles (LEAF)

- Self-flow fused cast grains concrete, casting in wooden forms, especially formulated for partial cold repairs, alternative to full block replacement (cost efficient solution)

TYPICAL CHEMISTRY





Al ₂ O ₃	ZrO ₂	SiO ₂	Na ₂ O	CaO
53.0%	33.3%	11.2%	0.8%	1.0%

Main crystallographic phases: corundum, monoclinic zirconia

PHYSICAL PROPERTIES

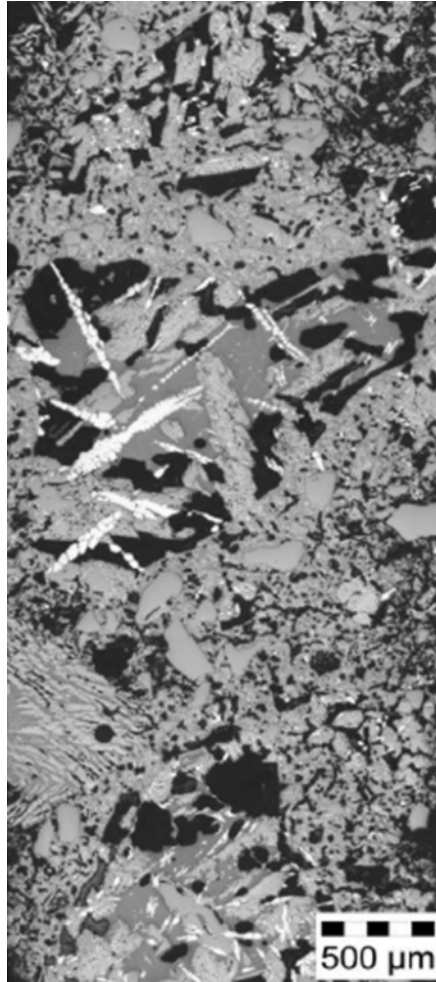
Bulk density	Typical open porosity	Green mechanical strength (110°C / 230°F)	Fired mechanical strength (1400°C / 2552°F)
3.2 T/m ³	17-19%	35 MPa	125 MPa

CORROSION RESISTANCE & GLASS PROPERTIES

Products	AZS ER1681	Repair CIP AZS	Repair Hot Overcoat AZS	AZS concrete from competition
Casting temperature	NA	Room T°	600°C / 1112°F	Room T°
Sintering	NA	1500°C / 2732°F	1500°C	1500°C
Open porosity	<1%	~19%	~22%	~20%
Photos of samples after dynamic corrosion test				

Al ₂ O ₃	53.8%
ZrO ₂	32.3%
SiO ₂	12.6%

Crystallographic phases:
Corundum
Zirconia (Monoclinic)



SEFPRO CARE

Fused Cast AZS grains:
Homogeneous structure
→ **Smooth** corrosion profile

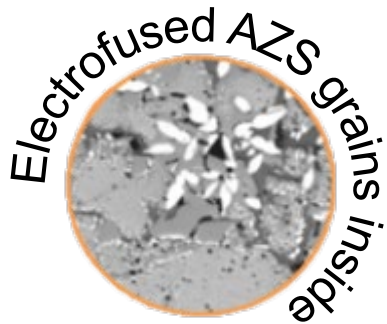
COMPETITION

Heterogeneous structure
→ **Weak phases corroded first** (Zircon & Mullite)
→ **Irregular wear pattern**



Al ₂ O ₃	62.3%
ZrO ₂	21.6%
SiO ₂	15.6%

Crystallographic phases:
Zircon
Mullite
Corundum



Same global chemistry but different grains choices

Electrofused AZS grains vs other AZS solutions

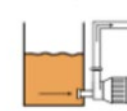
- **An electro-fused AZS grain concrete, especially formulated for cold repairs :**
- The CIP AZS is a self-flowing and self-leveling, hydraulic set concrete, used for glass contact or superstructure applications, in partial cold repair
- It enables fast repair of the superstructure, the furnace bottom and other areas in glass contact
- **Advantages :**
 - **Easy to apply** : thanks to its free-flowing properties, this product can be used in the most complex repair configuration
 - **Versatile** : its specific formulation makes it suitable in all parts of the furnace
 - **Longevity** : the use of electro-fused AZS grains gives to the product unique corrosion resistance properties
- **First application by SEFPRO done in 2011 :**
 - 20+ references
 - Tableware / Specialty / Container furnaces
 - Repair from 5 up to 150+ tons installed



To be mixed



Pumpable

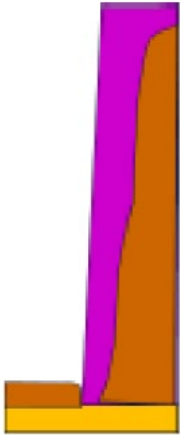


Castable

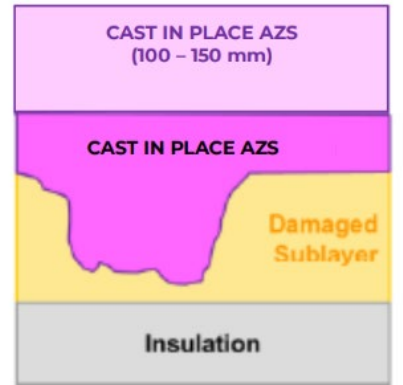


Cold





Sidewall or Dog House - Partial or Major Cold Repair



Furnace Bottom - Partial Cold Repair



Tuckstones - Partial Cold Repair

SEFPRO CARE ® | HOT BOTTOM AZS

Technical features :

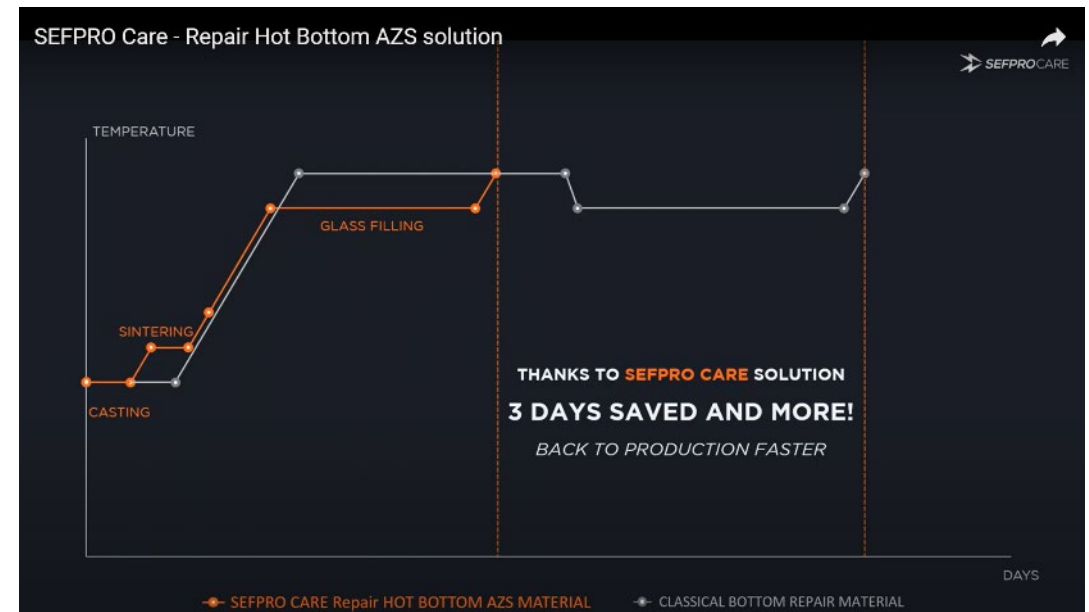
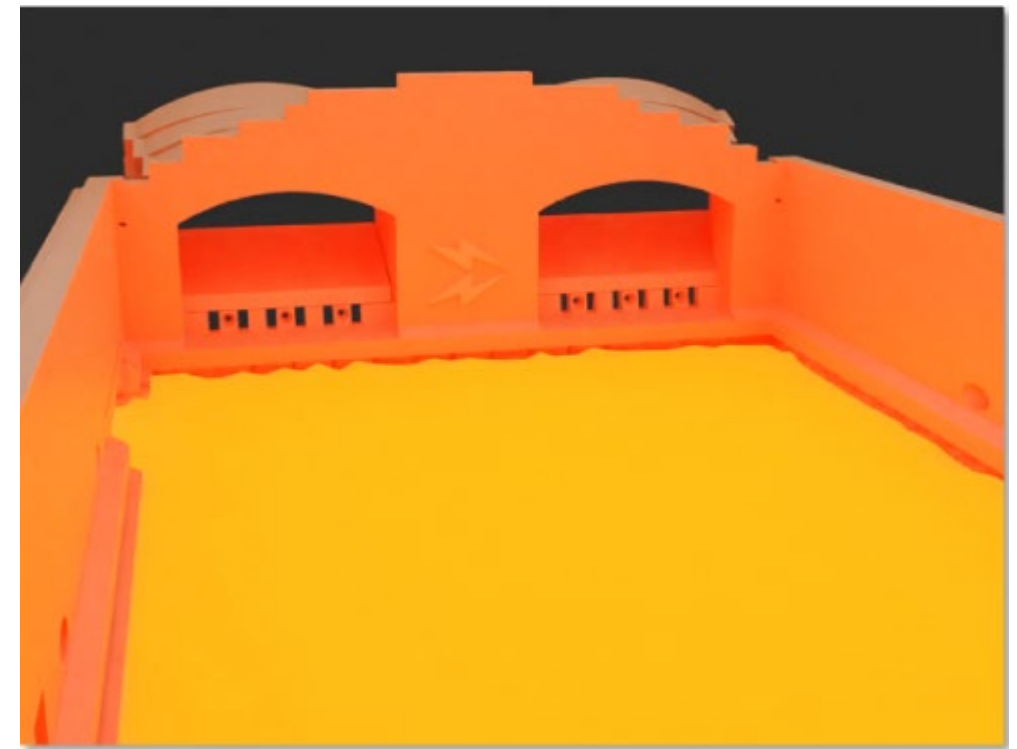
- Electro-fused grains : highest material compatibility with glass bath
- AZS : 33.0 % ZrO₂
- Casting at 1250°C – Sintering at 1350°C

Benefits :

- Quick return to full production (~3 days faster – lower energy consumption)
- Furnace preservation during repair
- Safe electrode installation
- High corrosion resistance

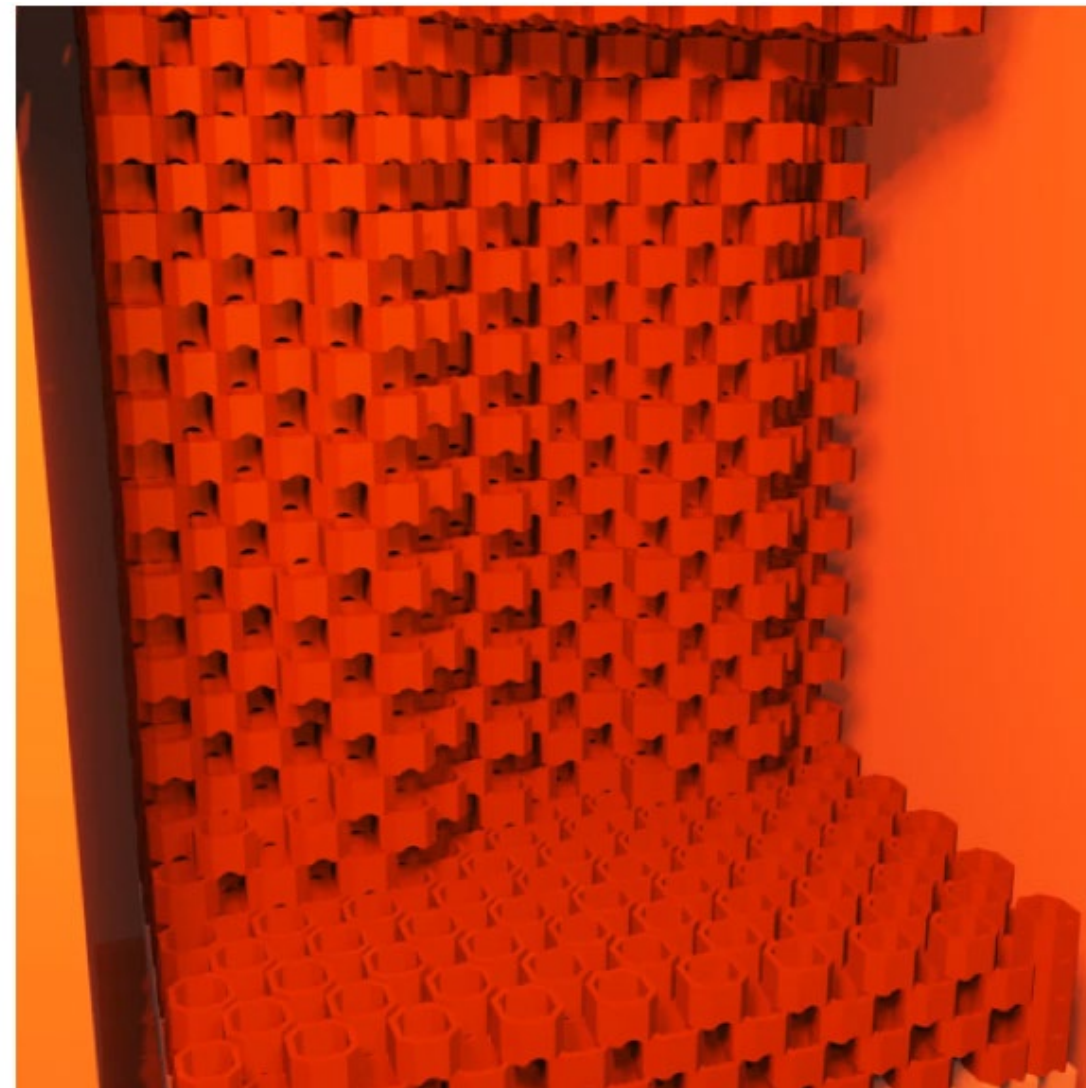
Competition benchmark :

- Competitors solutions : sintering at 1550°C – 1 curing cycle is mandatory before going back to production
- Risk for furnace and superstructure stability when changing temperature with empty furnace
- **First application by SEFPRO done in 2018 :**
 - 15+ references
 - Tableware / Container furnaces
 - Repair from 1 up to 60+ tons installed





Technology from LMS with SEFPRO Materials



Technology from LMS with SEFPRO Materials



Technology from LMS with SEFPRO Materials



Technology from LMS with SEFPRO Materials

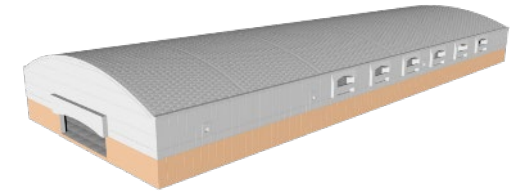
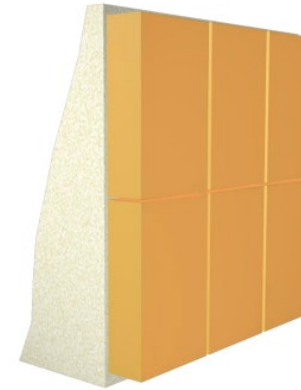
One supplier for multiple patching cases

SEFPRO proposes clear segmentation between premium and entry tiles

- TJ / Repair tiles are made from fused cast - void free - process
- LEAF AZS tiles are made from bonded process

TJ and Repair tiles are made from fused cast - void free - process :

- TJ tiles are 100 % controlled with tight length tolerance (-0.2 / -0.6 mm)
- Repair are statistically controlled with standard length tolerance (+1 / -2 mm)



EASY TO CUT



STOCK AVAILABLE



Repair Tiles and LEAF tiles are adapted for short lifetime extension or low exposition furnace area

	#1	#2	#3
Use case	Increase corrosion resistance where it's needed	Increase corrosion resistance Optimize repair cost	Provide Patching tiles in a matters of days Can be easily cutted on-site
Application	Premium Hybrid Patching	Cost Driven Hybrid Patching	Emergency Patching
SEFPRO Care Solutions	TJ tiles & Repair tiles	Repair tiles & LEAF AZS	LEAF AZS

| Thank you