



RHI MAGNESITA

RHIM's solutions for the Glass Industry

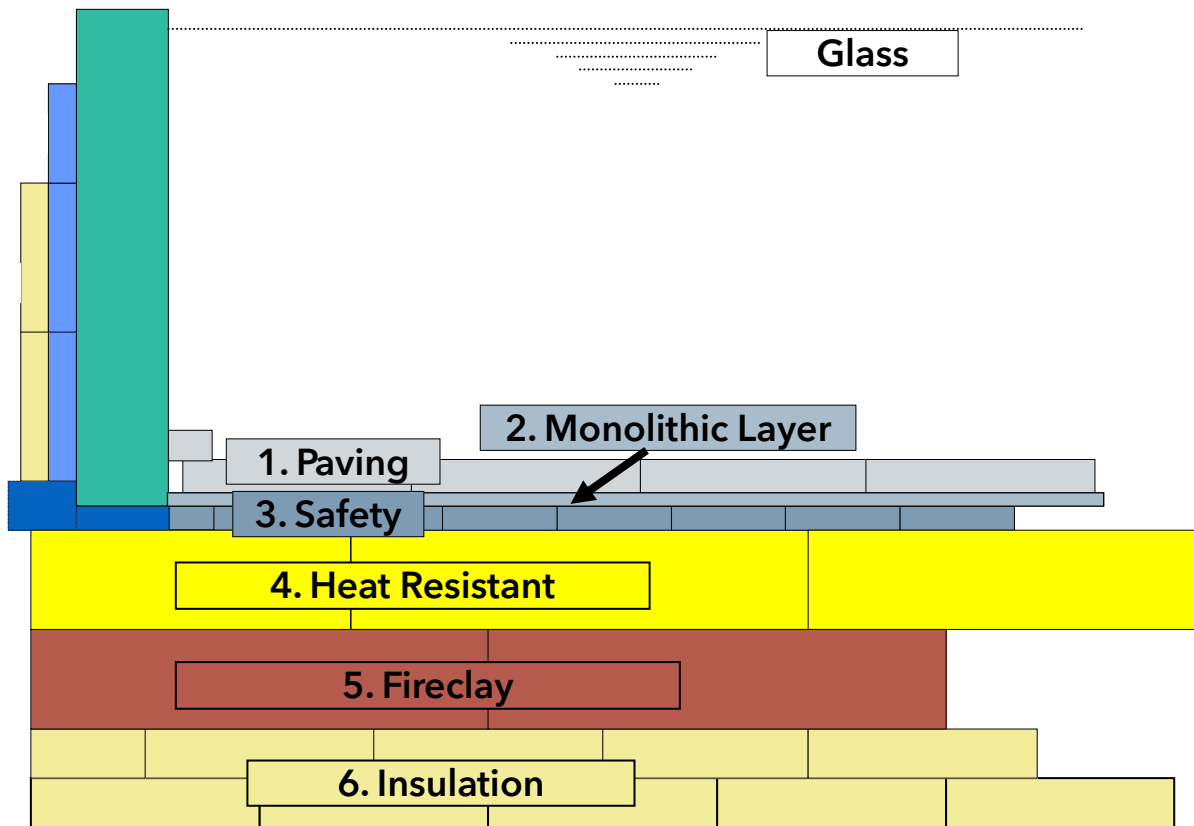
Melter Bottom Concept

September 2024



Upper & Lower Layers

Due to specific requirements, RHIM divides the bottom in two parts



Upper Layers

1. Paving
2. Monolithic Layer
3. Safety Layer

Requirements

- **Corrosion resistance** against glass
- Resistance against **metal drop drilling** (two approaches: **metal encapsulation** and **metal corrosion resistance**)
- **Upward Drilling** prevention
- High refractoriness

Lower Layers

4. Heat Resistant
5. Fireclay Layer
6. Insulation

Requirement

- **Refractoriness** according to the expected temperature profile
- **Mechanical** Properties; Cold Crushing Strength
- Optimum **compromise between insulation and bottom lifetime**

Upper Layers

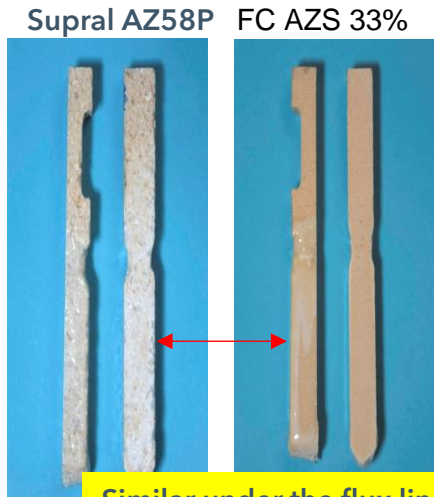
Paving – 32 % - 40% ZrO₂ AZS Fused Cast is the preferred choice for most melters

Supral AZ58P can be an option under some conditions

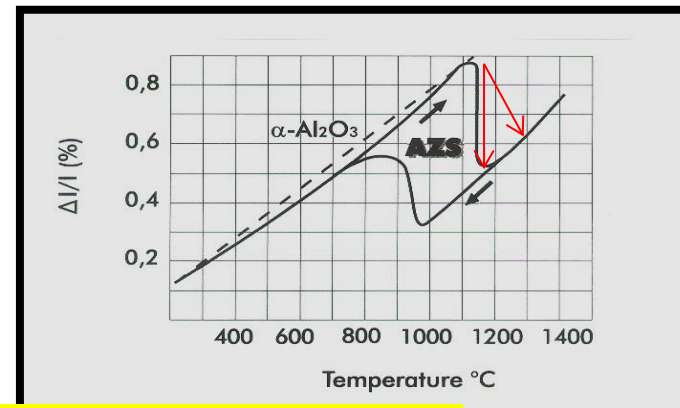
- Low temperatures
 - Float charging end
 - Container coloured glasses
- Shorter Campaigns
- Working End Alternative due to the less risk of glass defects

Advantages

- More stable expansion behavior
- Good corrosion resistance
- No Glassy phase (no exudation, no upward drilling boosted by exudation , low risk of cat scratches or glass defects)
- Lower thermal conductivity

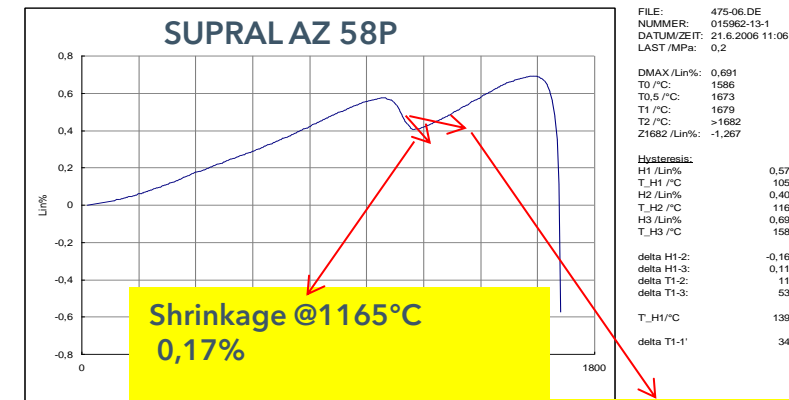


Corrosion test with soda lime glass 1400°C - 24h



Shrinkage @1165°C
0,35%

Shrinkage @1300°C
0,25%



Shrinkage @1165°C
0,17%

Shrinkage @1300°C
0,08%

Hysteresis starts with 24% ZrO₂ content in the brick

FILE: 475-06.DE
 NUMMER: 015962-13-1
 DATUM/ZEIT: 21.5.2006 11:06
 LAST /MPa: 0,2
 DMAX /Lin%: 0,691
 T0 /°C: 1586
 T0,5 /°C: 1673
 T1 /°C: 1679
 T2 /°C: >1682
 Z1682 /Lin%: -1,257
 Hysteresis:
 H1 /Lin%: 0,574
 T_H1 /°C: 1054
 H2 /Lin%: 0,407
 T_H2 /°C: 1165
 H3 /Lin%: 0,691
 T_H3 /°C: 1586
 delta H1-2: -0,167
 delta H1-3: 0,117
 delta T1-2: 111
 delta T1-3: 532
 T_H1 /°C: 1394
 delta T1-1': 340

Upper Layers

Monolithic layer

- Avoids glass penetration through the joints under the paving, prolonging the furnace lifetime
- Requires good glass corrosion resistance.
- Low shrinkage during heat-up to obtain a sealed layer with no gaps.
- Resistance against metal penetration is also needed

New developments: Self flowing mix for a faster and easier installation

DIDOFLO ZM 30-3-DE based on zircon mullite

DIDOFLO A89CR-3-DE based on Chrome alumina , metal drilling resistant, for coloured glasses

TWO APPROACHES

1) Metal corrosion resistant grades

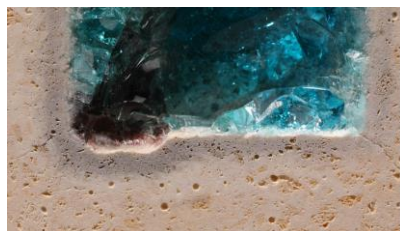
Based on Zircon Mullite or Chrome Alumina

DIDURIT ZM 465 0-3

DIDOFLO ZM 30-3

DIDOFLO A89CR-3

RESISTIT ZM 260



*Cup Tests; Soda Lime Glass
with copper droplet
120h @1370°C*

2) Metal encapsulating grades

Based on Zircon Silicate

RESISTIT ZS 748



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Upper Layers



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Safety Layer

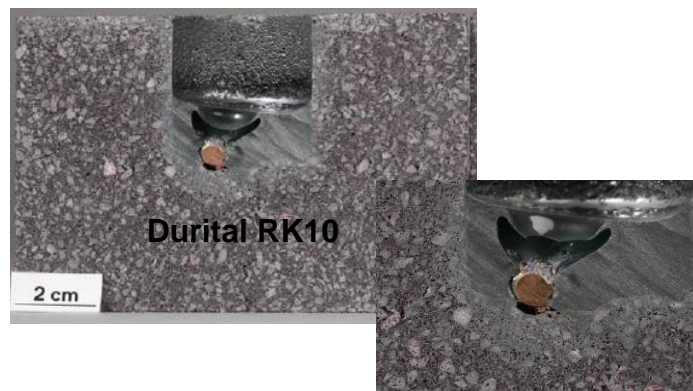
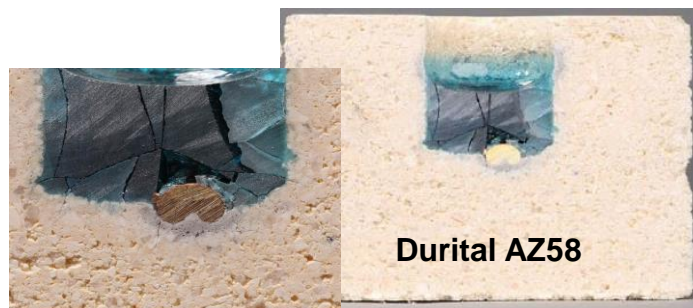
- Final protection against metal or glass penetration, having grade and thickness alternatives to target the specific need.
- Requires good glass corrosion resistance.
- Resistance against metal penetration is also needed

TWO APPROACHES

1) Metal corrosion resistant grades

Based on Zircon Mullite or Chrome Alumina

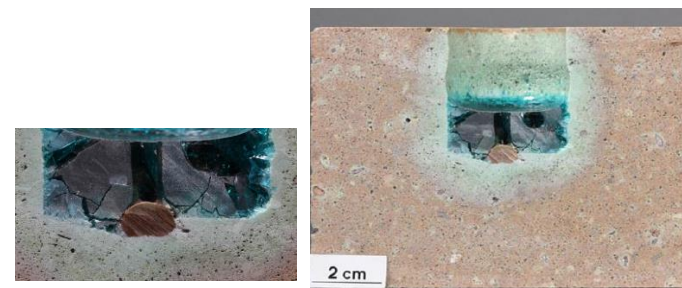
SUPRAL AZ 58P; performs as a second paving layer
DURITAL RK10



2) Metal encapsulating grades

Based on Zircon Silicate

ZETTRAL 65 GG

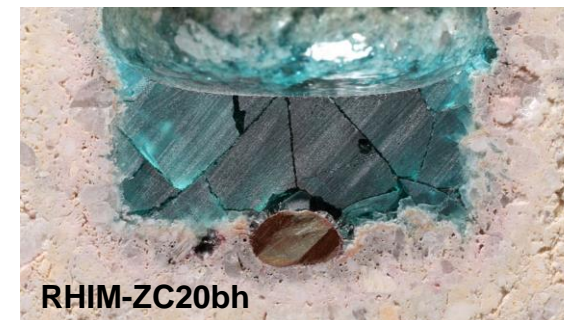


*Cup Tests; Soda Lime Glass
with copper droplet
120h @1370°C*

1) + 2) Metal encapsulation and metal corrosion resistance balance

RHIM ZC 20 BH

Based on Zircon Corundum ;
during heat up a mullitisation
process occurs, and the
Zircon Silicate excess
contributes to the metal
encapsulation

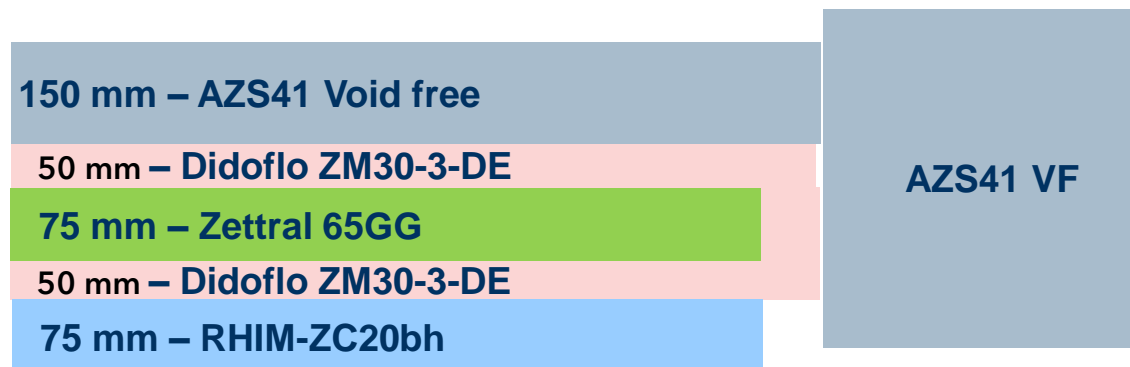


Highly Boosted Furnace Bottoms



For increased bottom boosting , due to higher temperatures, it is crucial to reinforce the bottom and avoid glass penetration.

- Higher glass temperature and lower viscosity allows easier movement between layers.
- Increase of Glass Currents amplifies the corrosion mechanisms.
- **A second Monolithic Layer is suggested for highly boosted bottoms and for extreme cases even a second Safety Layer can be considered.**
- The second monolithic layer stops glass infiltration. Situated at a lower temperature it would perform better towards more viscous glass, also considering the lower shrinkage risks.



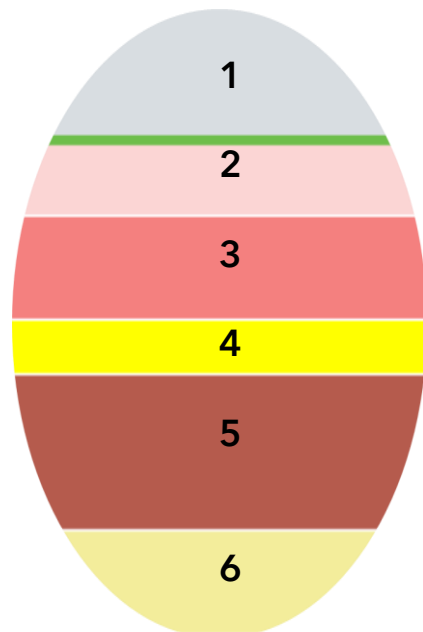
Lower Layers



Requirement

- Refractoriness according to the expected temperature profile
- Mechanical Properties; Cold Crushing Strength
- *Balance between a good insulation and furnace bottom lifetime.*
- The application of unfired insulating bottom blocks, provided with the same features of the fired grades, offer the advantage of a high dimensional accuracy directly after the pressing process (+0-2mm) and consequently a more competitive price with an overall lower CO₂ footprint

Grade Selection and Layer Thickness According to the expected Temperature Profile



4. Heat Resistant Layer - - 75 to 150 mm Thick

RHIM-S60bh

RHIM-S60b

5. Fireclay Layer -

RHIM-F40bh

RHIM-F40b

6. Insulating Layer -

RHIM-LiF13bh

RHIM LiF12b

Other insulation grades are available as necessary

Unfired - Pressed - Large Blocks

Unfired Key-points

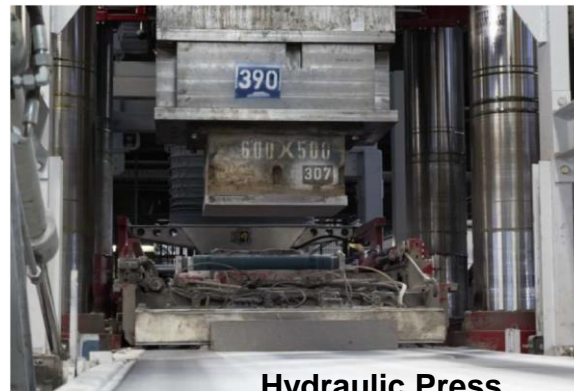
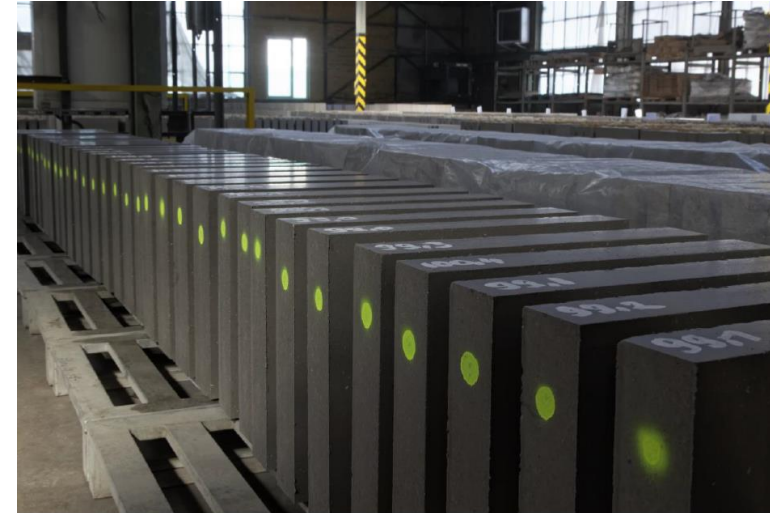
- Hydraulic Bonded
- Less energy for production therefore lower CO₂ footprint
- Shorter production times without the firing process

Pressed Key-points

- Hydraulically pressed block offers very homogenous macrostructure & microstructure (no cavities, voids or irregular porosity in the block)
- The surface appearance is homogenous and smooth
- Dimensional consistency from pressing process

Size Key-points

- Large shapes to minimize Joints
- Provides a faster installation
- High dimensional accuracy, (+0-2)mm



4. Heat Resistant Layer **RHIM-S60bh**
 - Sillimanite
 - 1000x498x300 mm Max size
5. Fireclay Layer **RHIM-F40bh**
 - 1000x500x350 mm
6. Insulation Layer **RHIM-LiF13bh**
 - 1000x500x200 mm

Fired grades are also available



RHI MAGNESITA

Thank you for your attention

Get in Touch

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