REFRACTORIES FOR GLASS INDUSTRY
Overview of Glass Industry

• Refractories for Glass- Market

• Present operational practice in Glass making Process.

• Fundamentals of refractories selection for Glass Industry

• Recent Trends in Refractories for Glass

• Conclusion
Refractories for Glass - Market
Refractories Market Segmentation
Industry-wise (Global)

- Steel: 70%
- Cement & Lime: 6%
- Ceramics: 6%
- Chemical: 4%
- Glass: 4%
- Others: 6%
- NF Metals: 3%
Refactories Market Segmentation
Industry-wise (India)

- Steel: 78%
- Cement & Lime: 8%
- Glass: 2%
- Ceramics: 5%
- NF Metals: 4%
- Chemical: 3%
Specific Refractories Consumption in Glass

![Graph showing specific refractories consumption in glass](image)
World Market Trend of Refractories for Glass Industry

- Declining specific refractory consumption
- Conventional products losing ground
- Customer driven product design
- Increasing demand for Total Refractories Solutions
Indian Glass Market

• India represents one of the largest markets and manufacturing capacity in Asian region for glass products after China.

• About 100 large scale companies which operate with modern and large scale melting technologies.

• They are mostly located in Gujarat, Mumbai, Kolkata and Hyderabad.
Indian Glass Market

• The Indian Glass industry is also represented by more than 300 medium and small-scale cottage industry units.

• The historical Glass-making town of Firozabad in UP state, which meets 30% of the demand for glass products in the country.
Present Operational Practice in Glass Making Process
Present Operational Process for Glass Industry

- Higher Operating temperatures
- Use of higher capacity Furnaces
- Longer Campaigns
- Oxy Fuel firing & higher melting rate
- High Value Products like Float Glass (Infrastructure developments) and Fiber glass

- High resource and Energy Consumption (Float Glass)
  - Fuel oil-50.2%,
  - Raw Mix/ Coal-35.7%,
  - Power-6.4% and
  - Others-7.7%
Fundamentals of Refractories
Selection
Selection of Proper Refractory Material
Recent Trends in Refractories for Glass
## Refractories for Different Parts of Glass Tank Furnace

<table>
<thead>
<tr>
<th>Application</th>
<th>Application Conditions</th>
<th>Application Requirements</th>
<th>Recommended Refractories</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crown</td>
<td>Alkali Vapors, High temperature</td>
<td>Volume stability, Low permeability, high refractoriness</td>
<td>Super duty silica bricks</td>
</tr>
<tr>
<td>Super structure</td>
<td>Wear by carried over batch constituents, High temperature.</td>
<td>High thermal shock resistance, Corrosion and erosion resistance</td>
<td>Zirconia-Mullite Bricks, Mullite Bricks</td>
</tr>
<tr>
<td>Lower Side walls</td>
<td>High Temperature, Glass Corrosion</td>
<td>Corrosion resistance</td>
<td>Zirconia-Mullite Bricks</td>
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## Refractories for Different Parts of Glass Tank Furnace

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<tr>
<td>Bottom Paving</td>
<td>High Temperature, Glass Corrosion, High load</td>
<td>High Refractoriness under Load, Corrosion resistance</td>
<td>Fusion Cast AZS-Refactories</td>
</tr>
<tr>
<td>Safety Layer</td>
<td>High Load</td>
<td>High Refractoriness under Load</td>
<td>High Alumina Bricks</td>
</tr>
<tr>
<td>Insulation</td>
<td>Higher Thermal Load</td>
<td>Low Thermal Conductivity, good mechanical strength.</td>
<td>Silica Insulating bricks</td>
</tr>
<tr>
<td>Repair</td>
<td>Alkali Vapor Corrosion.</td>
<td>Good Thermal Shock &amp; Corrosion resistance</td>
<td>Fused Silica bricks, Zircon based Ramming &amp; Patching masses</td>
</tr>
</tbody>
</table>
Super-Structure, side wall and Port Area

Special properties:

- Zircon Mulite, Chrome Alumina, Mullite Corundum, AZS pressed & sintered, AZS fused-cast block etc. are used for low porosity, high thermo-mechanical strength, chemical resistance leads to enhance furnace life, lower Sp.Ref. consumption and for energy savings which reduces cost of production.
Bottom Paving by AZS Fusedcast block

Special Properties:

- Zero Tollerance, paving block
- High temperature Chemical and erosion resistance
- High Temperature Volume stability.
- Low porosity
- S-3 DCL quality
# Refractories for Re-generator

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<tr>
<td>Port Lining</td>
<td>Wear due to flue gases and batch carry over</td>
<td>Erosion Resistance</td>
<td>Fusion cast AZS refractories.</td>
</tr>
<tr>
<td>Chamber Crown</td>
<td>Alkalies, High temperature</td>
<td>Volume stability, Low permeability, high refractoriness</td>
<td>Super duty silica bricks, Fused Mullite bricks</td>
</tr>
<tr>
<td>Chamber Wall</td>
<td>Alkali Vapors</td>
<td>Alkali Resistance</td>
<td>96-98% Magnesite Bricks</td>
</tr>
<tr>
<td>Ride arch. Lower wall</td>
<td>Solidification and Liquification of alkalis</td>
<td>Alkali Resistance</td>
<td>Andalusite Bricks</td>
</tr>
</tbody>
</table>
High Alumina and Basic Chimney Checkers Block for Regenerator

Alumina Chrome, Magnesia, Mag-Zir Chimney checkers block with new design for Regenerators application for Energy savings solution due to large heating surface, high heat transfer and low tendency of blocking and clogging.
New Generation Refractories for Glass Industry

- Fusedcast AZS (ZrO2 Content: 33, 36%, 41%)
- Chromic Oxide block (Cr2O3%: 30 to 90%)
- Zircon Mullite
- Fused Mullite (High creep resistance)
- Silimanite/ Andalusite Block
- Fused Silica Bricks
- 98% MgO, MgO-ZrO2 bricks and Checkers
- Silica Insulation bricks
- Mullite light wt insulation bricks
- Bubble Alumina Insulation
Conclusion

• Glass industry is going through a key challenges for:
  • Enhance furnace life
  • High productivity
  • Energy efficiency
  • Protection of environment

• Refractory industries needs to accelerate the development of technology & product quality.

• Refractory industry needs to have close association with Technology providers to render a complete refractory solutions to meet above demands from Glass Industry.
THANK YOU