REFRACTORIES

FOR

GLASS INDUSTRY

TRL KROSAKI REFRACTORIES LIMITED

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

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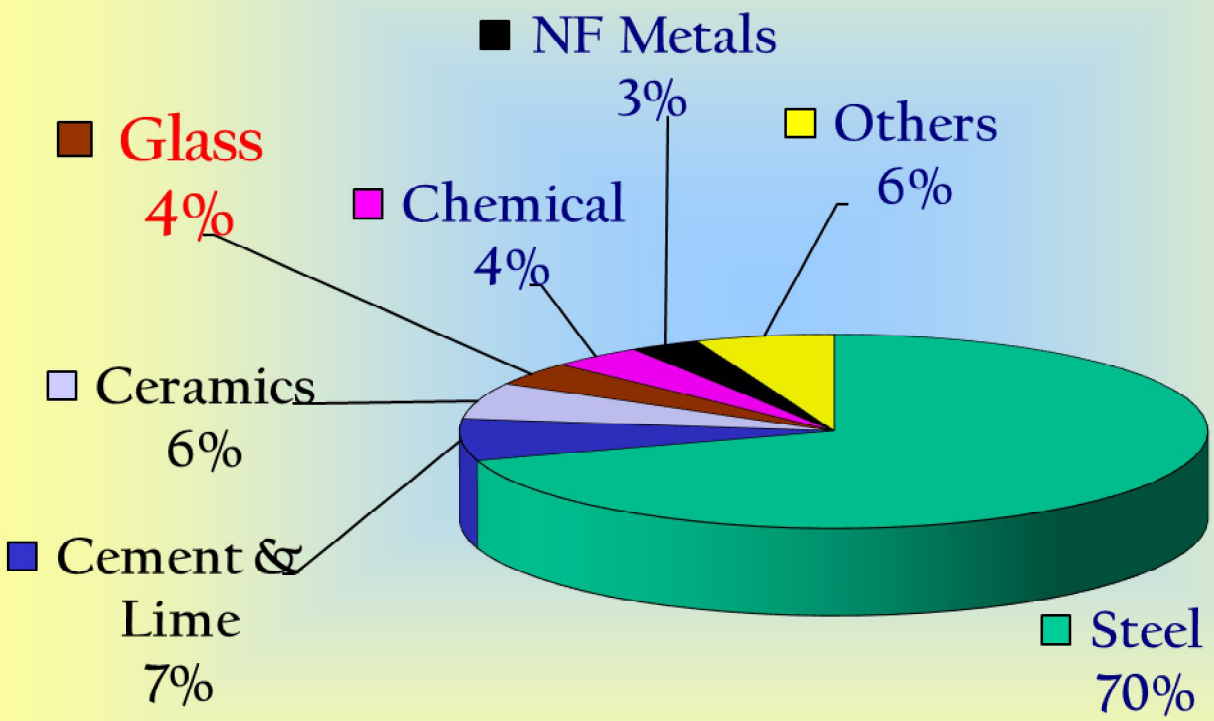
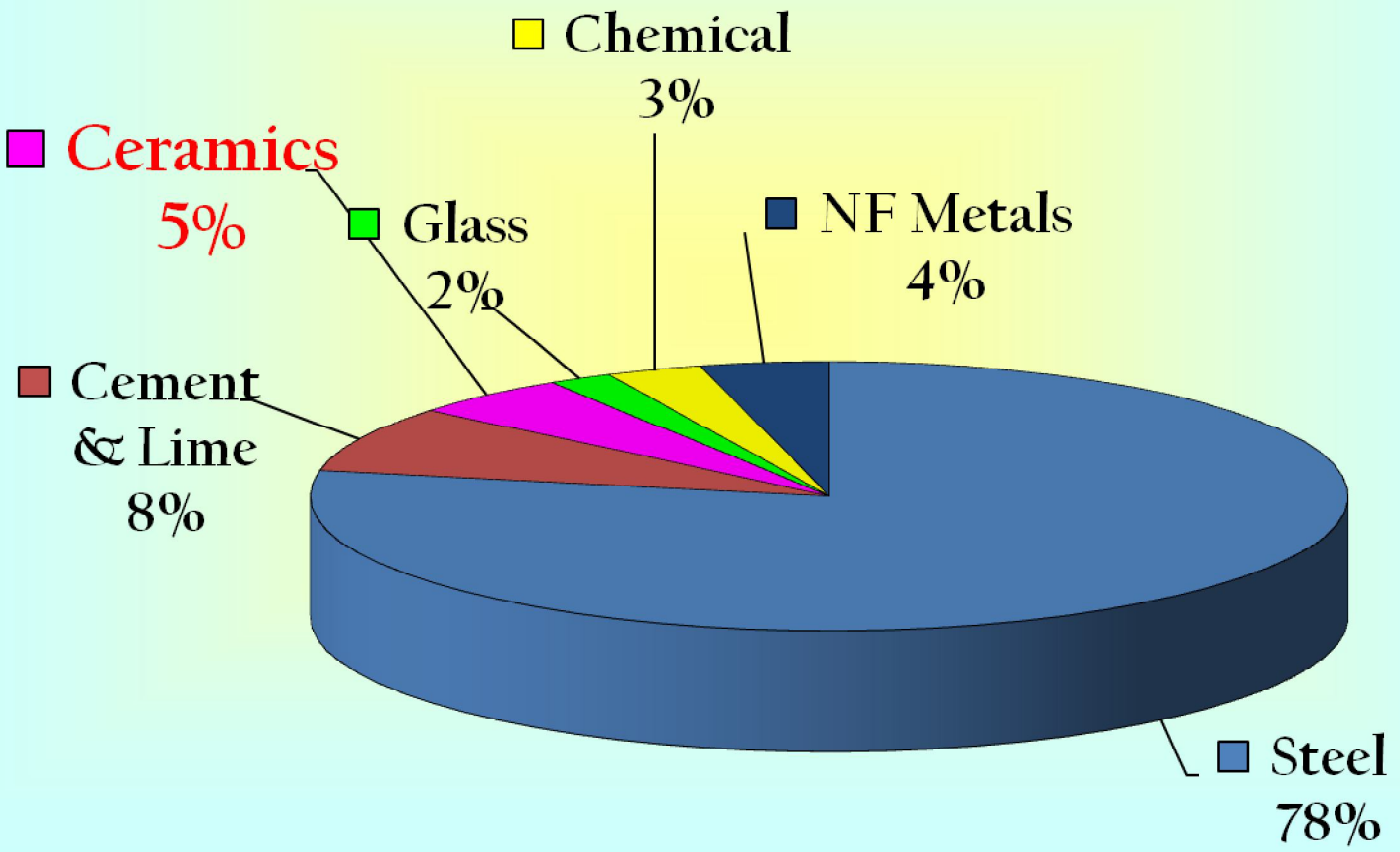
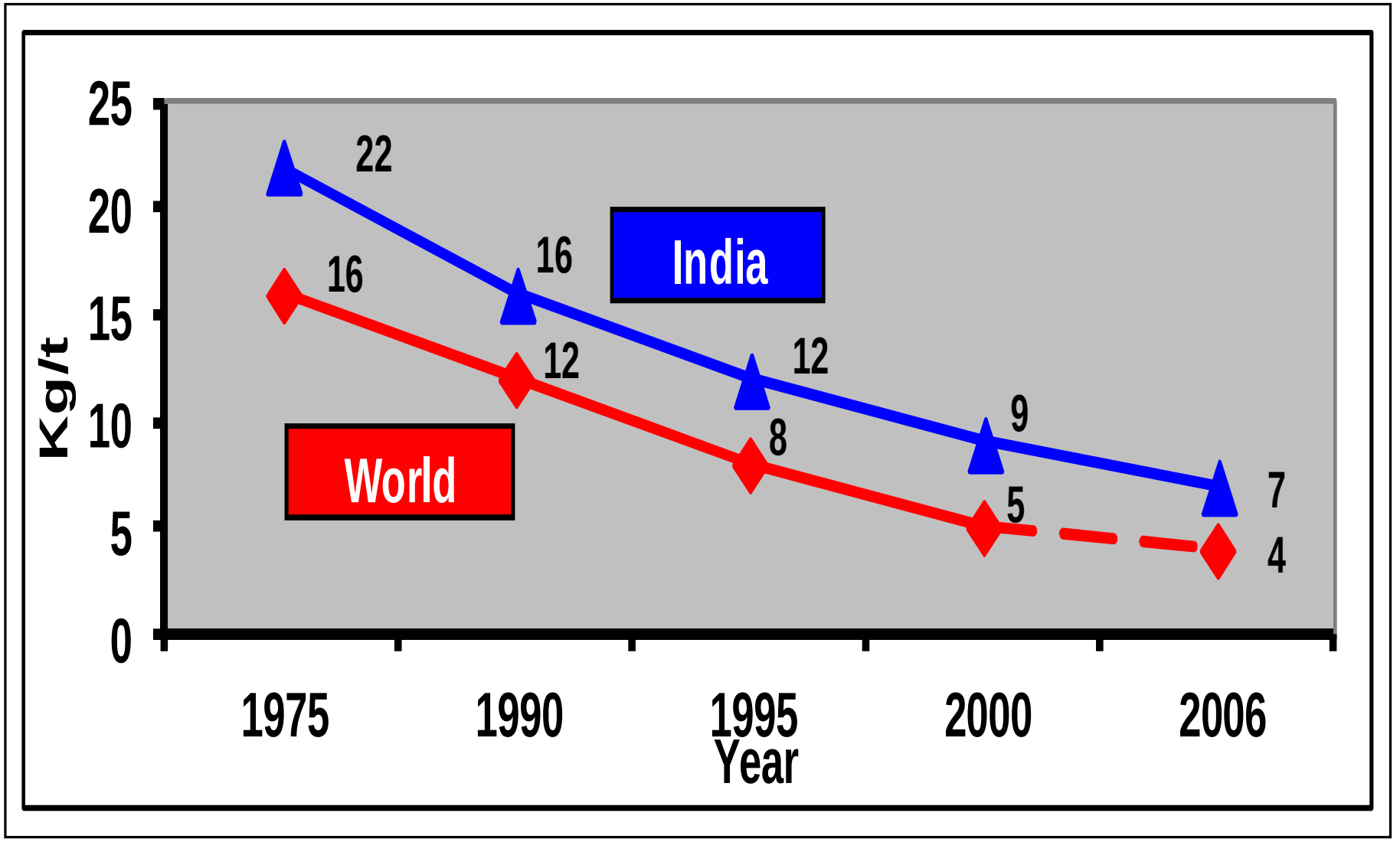
Refractories Market Segmentation Industry-wise (Global)



Refractories Market Segmentation Industry-wise (India)



Specific Refractories Consumption in Glass



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

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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

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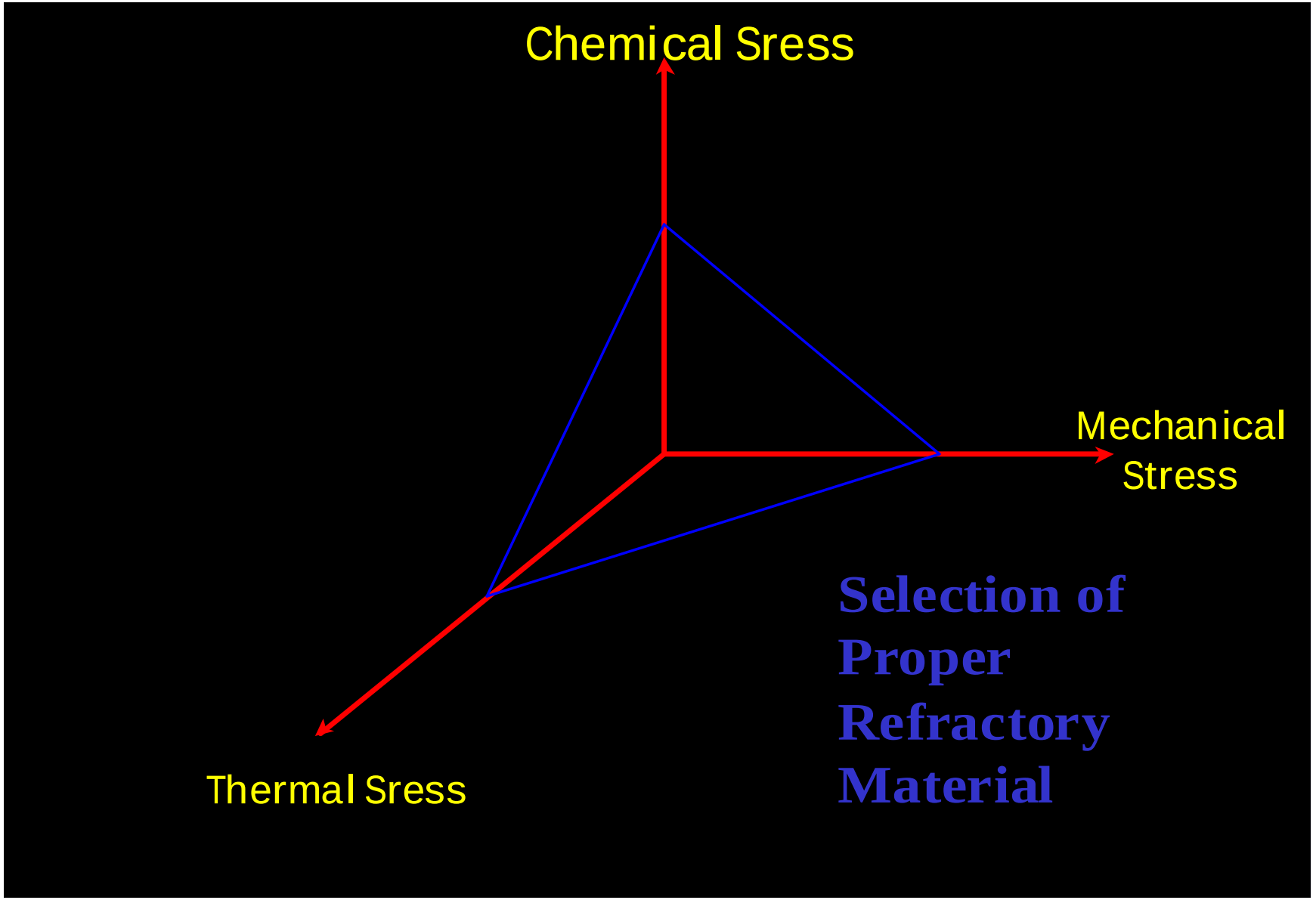
Chemical Sress
Mechanical Stress
Thermal Sress
Selection of Proper Refractory Material

Recent Trends in Refractories for Glass

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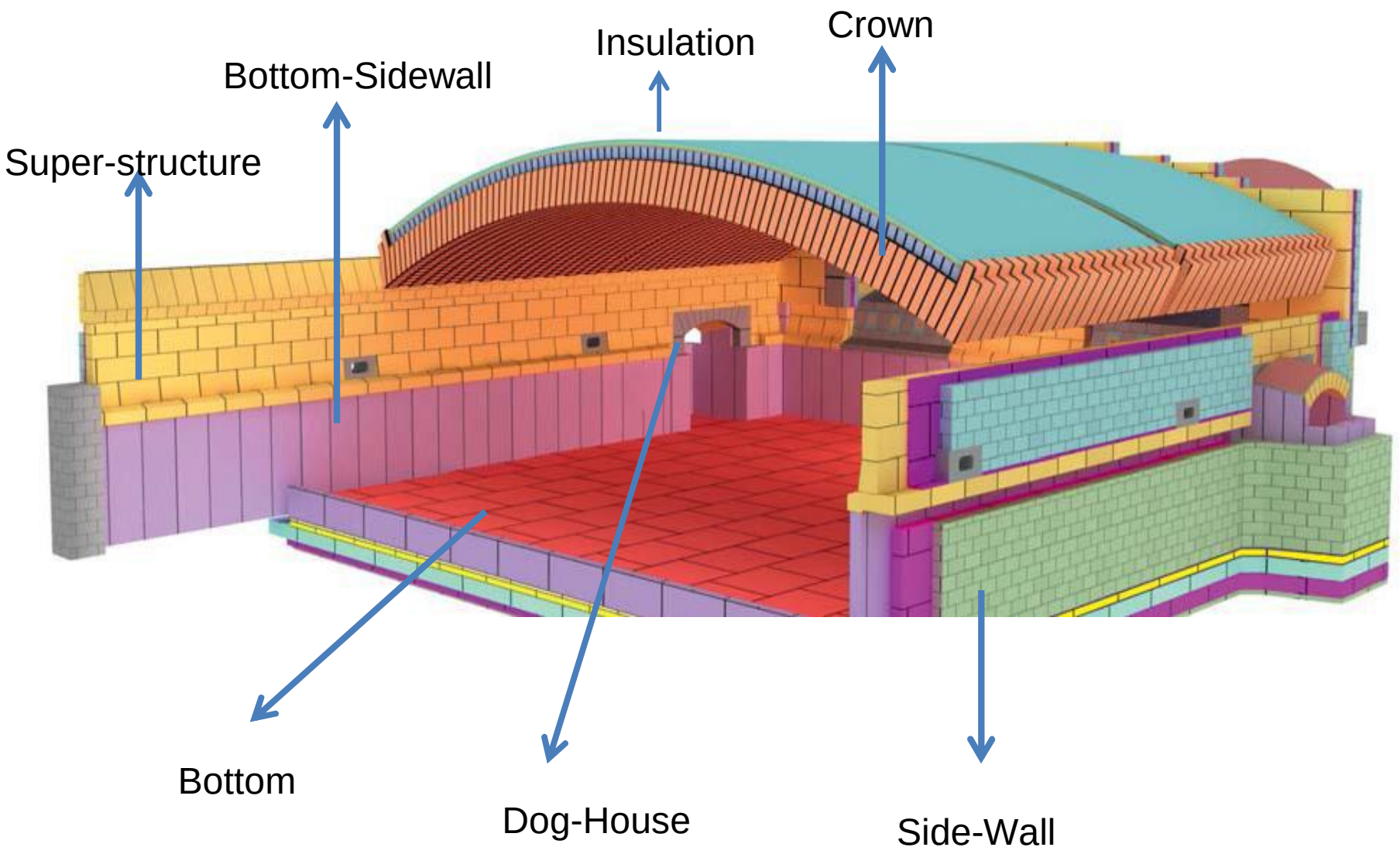
Schematic Diagram of Glass Tank Furnace



Refractories for Different Parts of Glass Tank Furnace

Application	Application Conditions	Application Requirements	Recommended Refractories
Crown	Alkali Vapors, High temperature	Volume stability, Low permeability, high refractoriness	Super duty silica bricks
Super structure	Wear by carried over batch constituents, High temperature.	High thermal shock resistance, Corrosion and erosion resistance	Zirconia-Mullite Bricks , Mullite Bricks
Lower Side walls	High Temperature, Glass Corrosion	Corrosion resistance	Zirconia-Mullite Bricks

Refractories for Different Parts of Glass Tank Furnace

Application Part	Application Conditions	Application Requirements	Recommended Refractories
Bottom Paving	High Temperature, Glass Corrosion, High load	High Refractoriness under Load, Corrosion resistance	Fusion Cast AZS-Refractories
Safety Layer	High Load	High Refractoriness under Load	High Alumina Bricks
Insulation	Higher Thermal Load	Low Thermal Conductivity, good mechanical strength.	Silica Insulating bricks
Repair	Alkali Vapor Corrosion.	Good Thermal Shock & Corrosion resistance	Fused Silica bricks, Zircon based Ramming &Patching masses

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

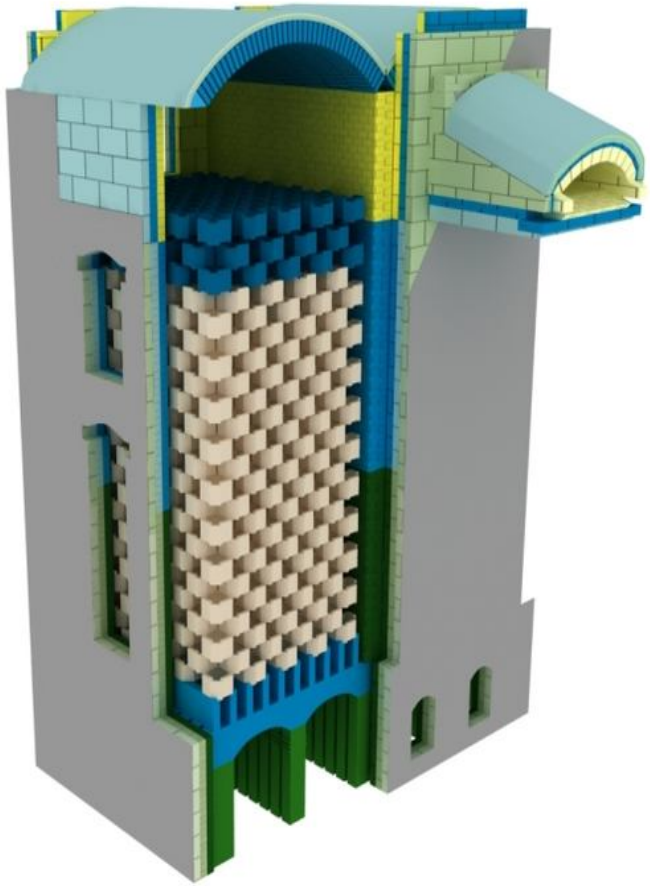
Special Properties:

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

Refractories for Re-generator

Application Part	Application Conditions	Application Requirements	Recommended Refractories
Port Lining	Wear due to flue gases and batch carry over	Erosion Resistance	Fusion cast AZS refractories.
Chamber Crown	Alaklies, High temperature	Volume stability, Low permeability, high refractoriness	Super duty silica bricks, Fused Mullite bricks
Chamber Wall	Alkali Vapors	Alkali Resistance	96-98% Magnesite Bricks
Ride arch. Lower wall	Solidification and Liquification of alkalis	Alkali Resistance	Andalusite Bricks

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

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