Approaches to Fuel saving
&
Glass Quality improvements

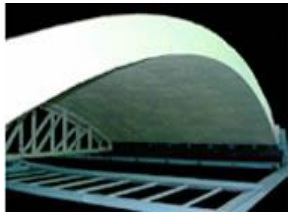
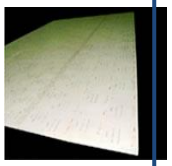
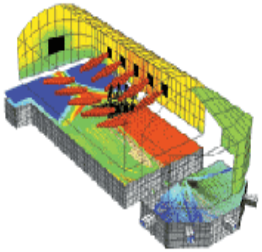
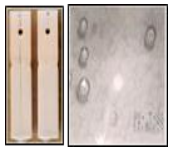
Legacy of 100 years

AGC AGC CERAMICS CO., LTD.

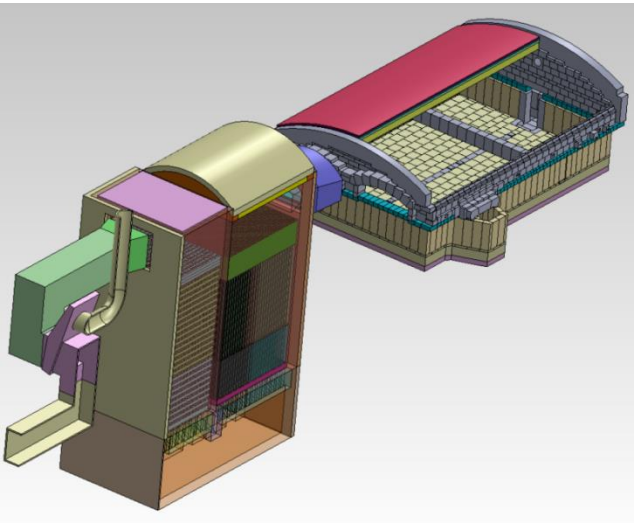
Approaches to

1) Fuel saving

2) Glass quality improvement

Refractory	Simulation service	Furnace engineering	Knowledge and Experience
 	 	 	 

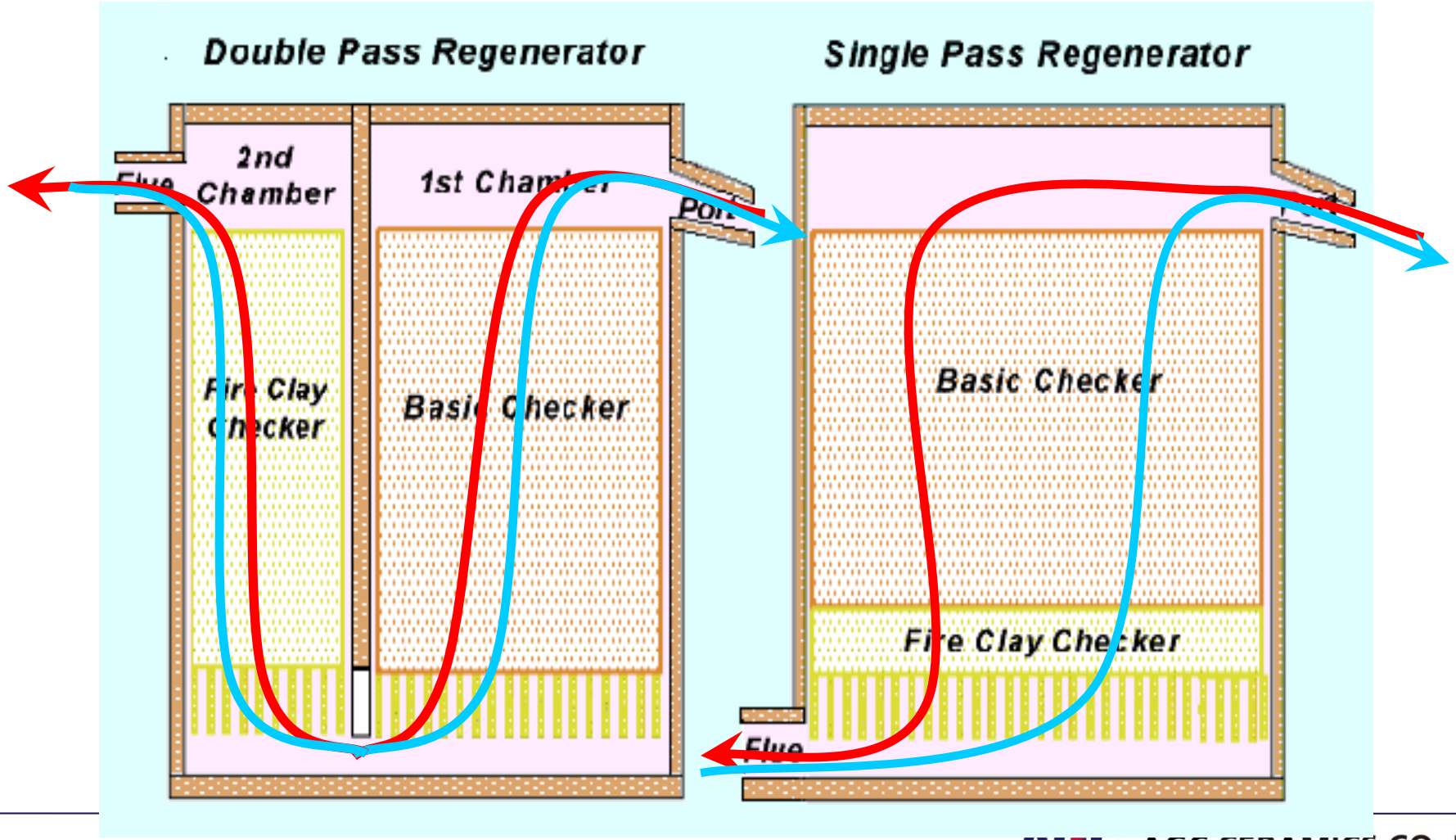
Key Device -1 for Fuel saving



Hyper Regenerator System

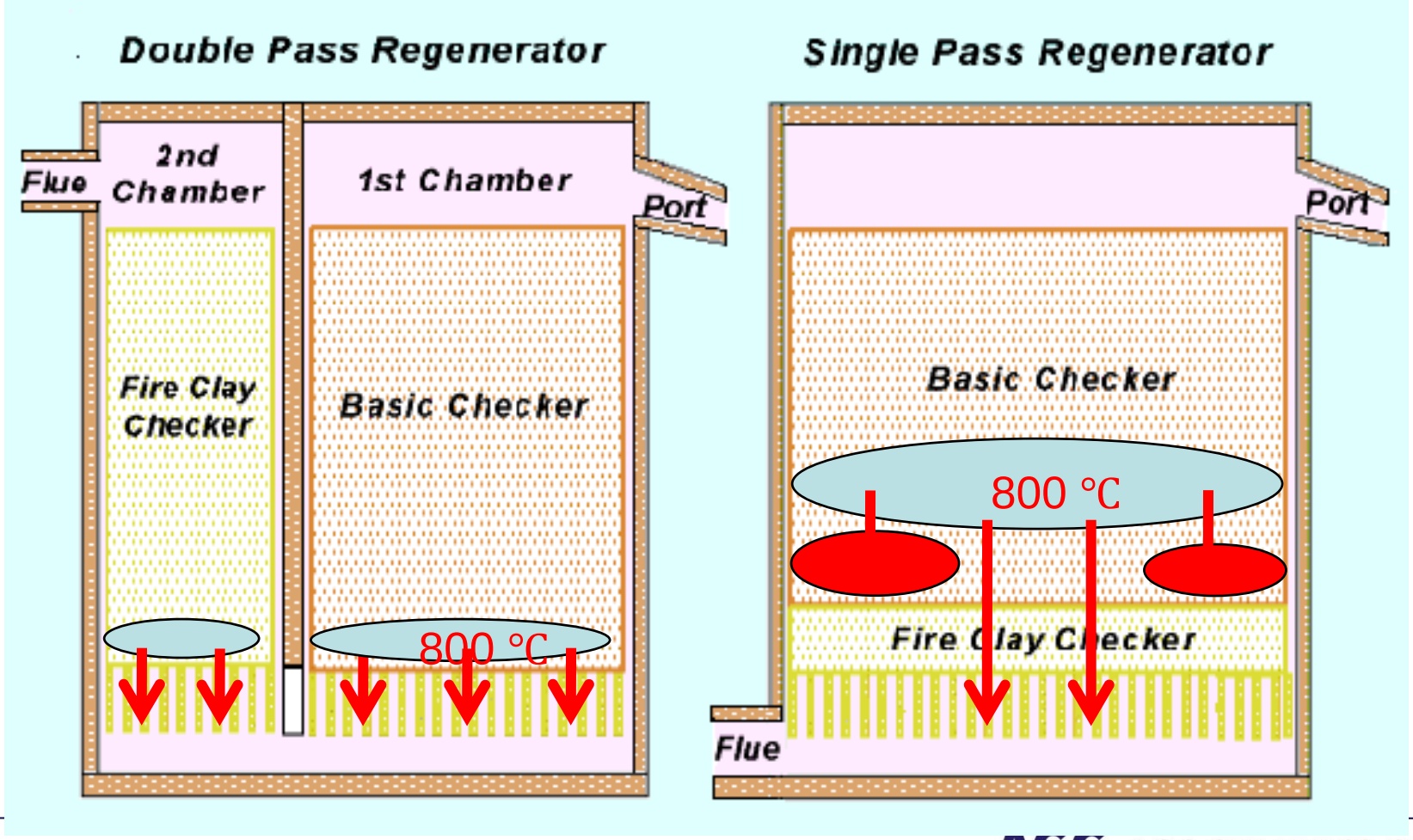
Hyper Regenerator System

Prevention of unbalanced air-flow & gas-flow



Hyper Regenerator System

Prevention of checker clogging



Hyper Regenerator System

- Double pass structure

- Prevention of unbalanced air-flow and gas-flow
- Prevention of checker clogging
- Optimum material selection

and

Proper checker design for efficient heat exchange

Key Device -2 for Fuel saving

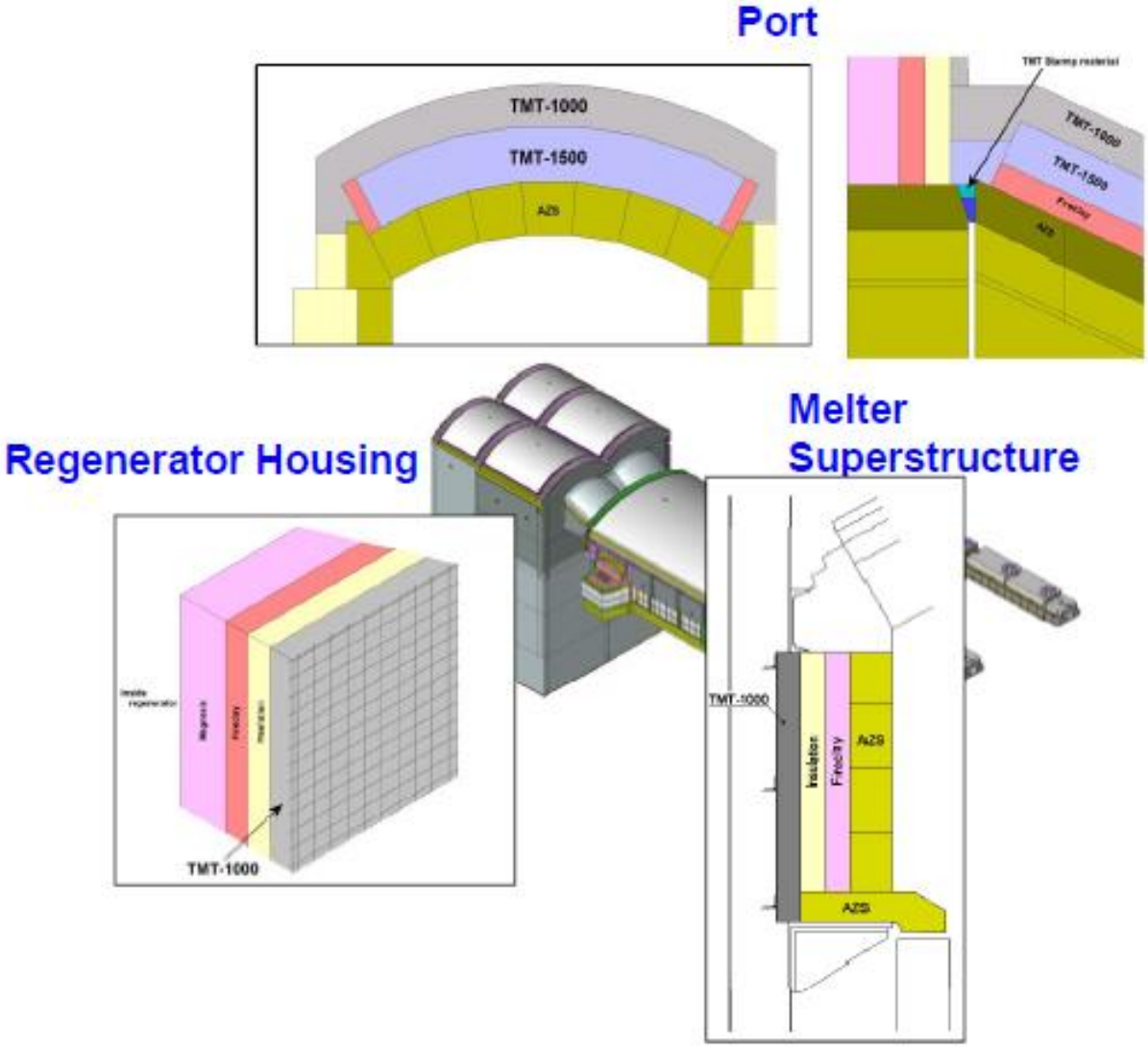
THERMOTECT™

High thermal insulating castable

Features of THERMOTECT™

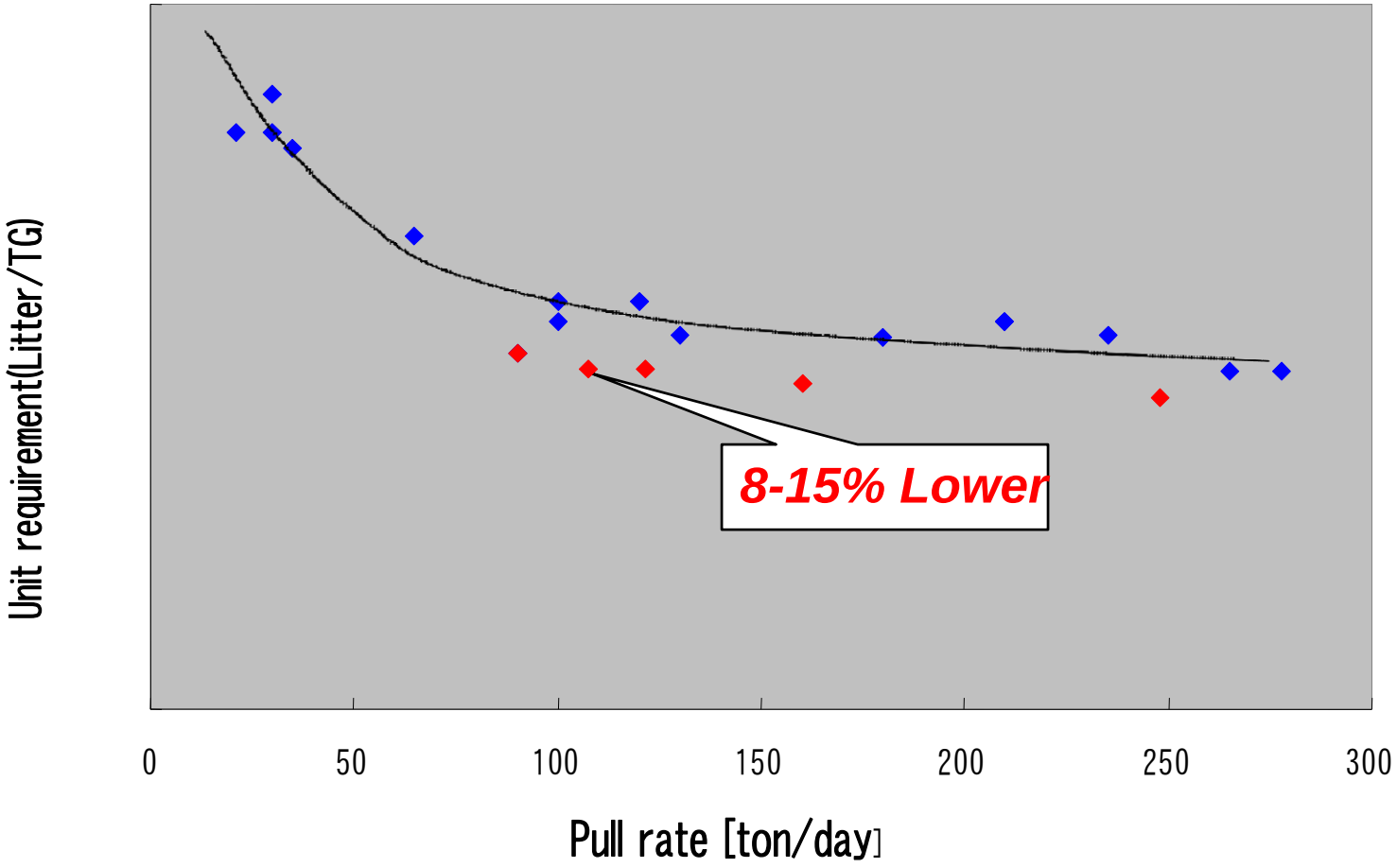
- 1.High thermal resistance
  - Applicable over 1600℃
- 2.High thermal insulation properties
  - Equivalent efficiency to conventional insulation brick
- 3.Low shrinkage
  - Linear shrinkage after heating at 1600℃ hardly changes
- 4.Easy on-site installation
  - Either castable or Pre-cast block
- 5.Perfect prevention of gas leakage
  - Reduction of the amount of the fuel used
- 6.Human body-friendly
  - Non **R**efractory **C**eramic **F**iber (RCF)

Applications of Thermotect

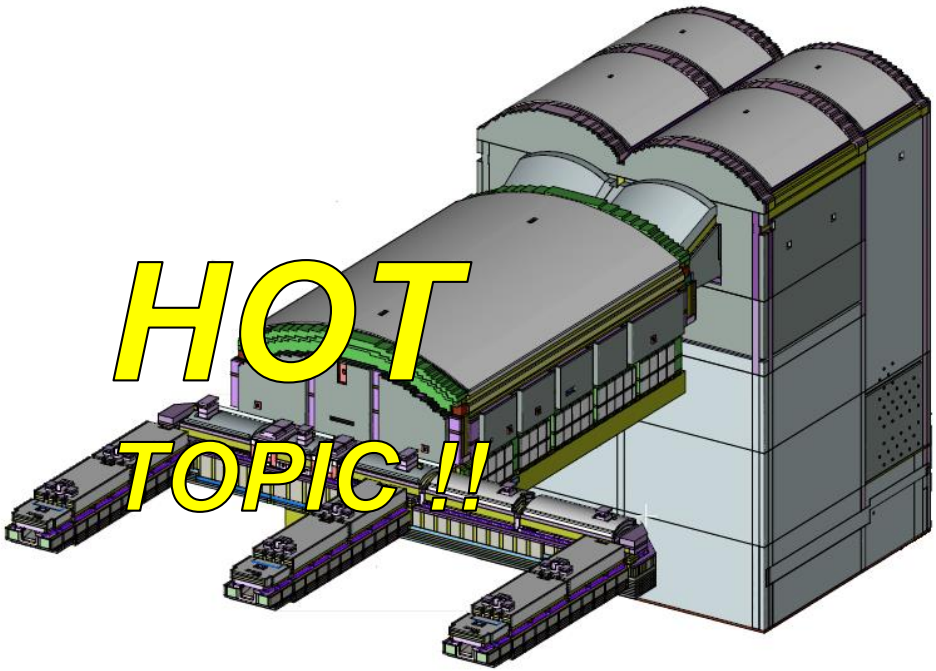


Result of Energy saving

Fuel Consumption record on AGCC's Delivered



Result of Energy saving



AGCC
Brand - New
High Performance
Regenerator System
And Glass Melter

AGCC Brand-New Hyper Regenerator System

got the official subsidy of

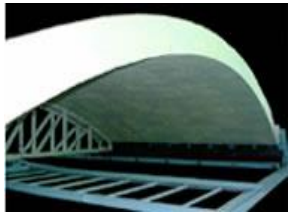
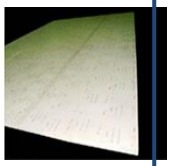
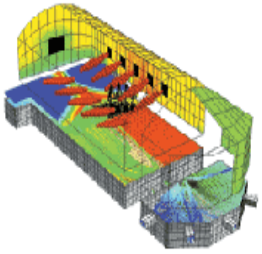
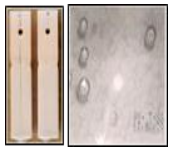
the Ministry of the Environment , Japan .

(Carbon dioxide emissions control measures project cost subsidies.)

Approaches to

1) Fuel saving

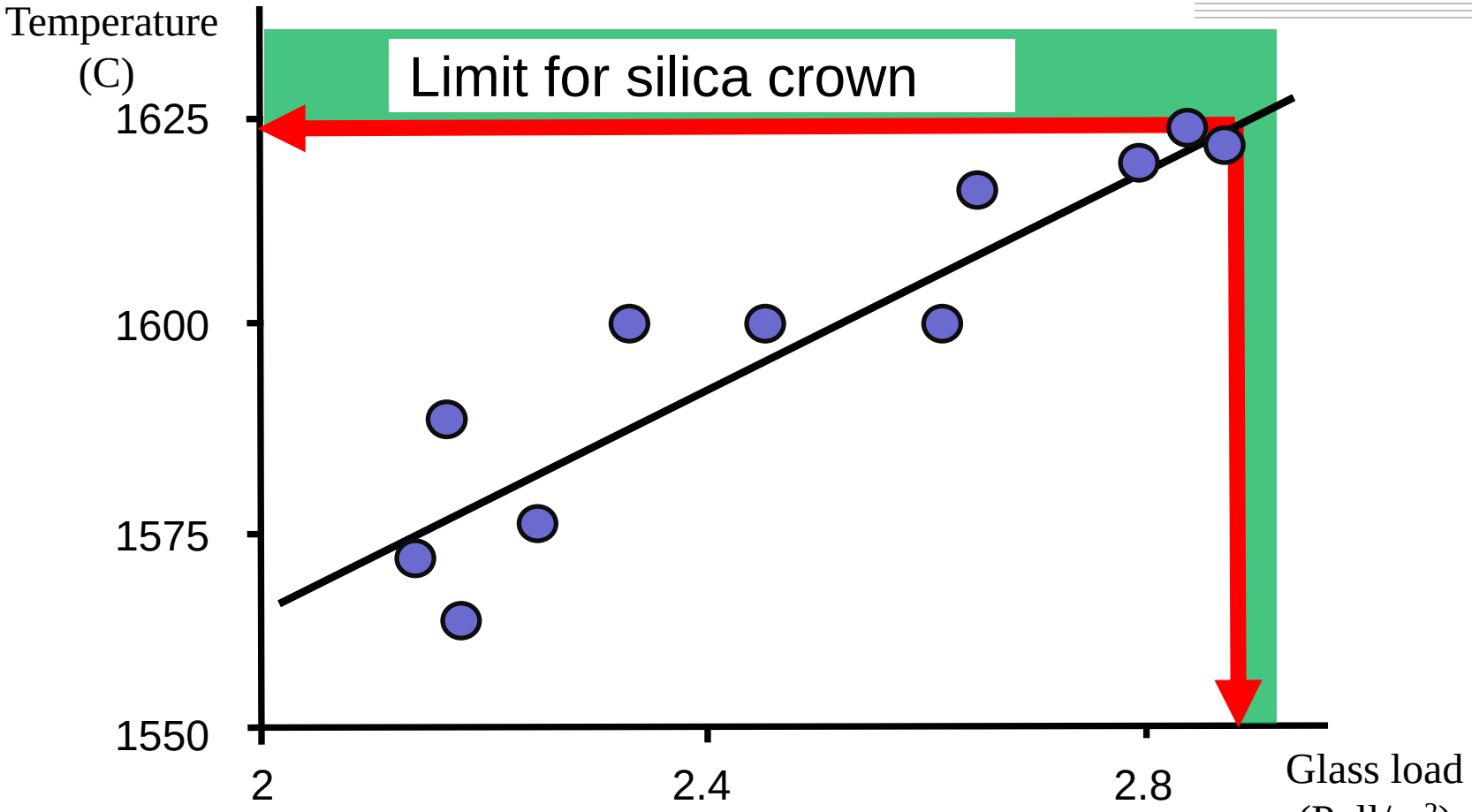
2) Glass quality improvement

Refractory	Simulation service	Furnace engineering	Knowledge and Experience
 	 	 	 

Corrosion Mechanism of

Fused Cast Refractories

Corrosion Mechanism



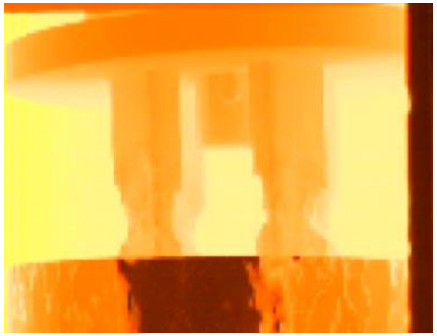
The relationship between temperature and glass load[1)]

In temperature increasing, glass load become higher.

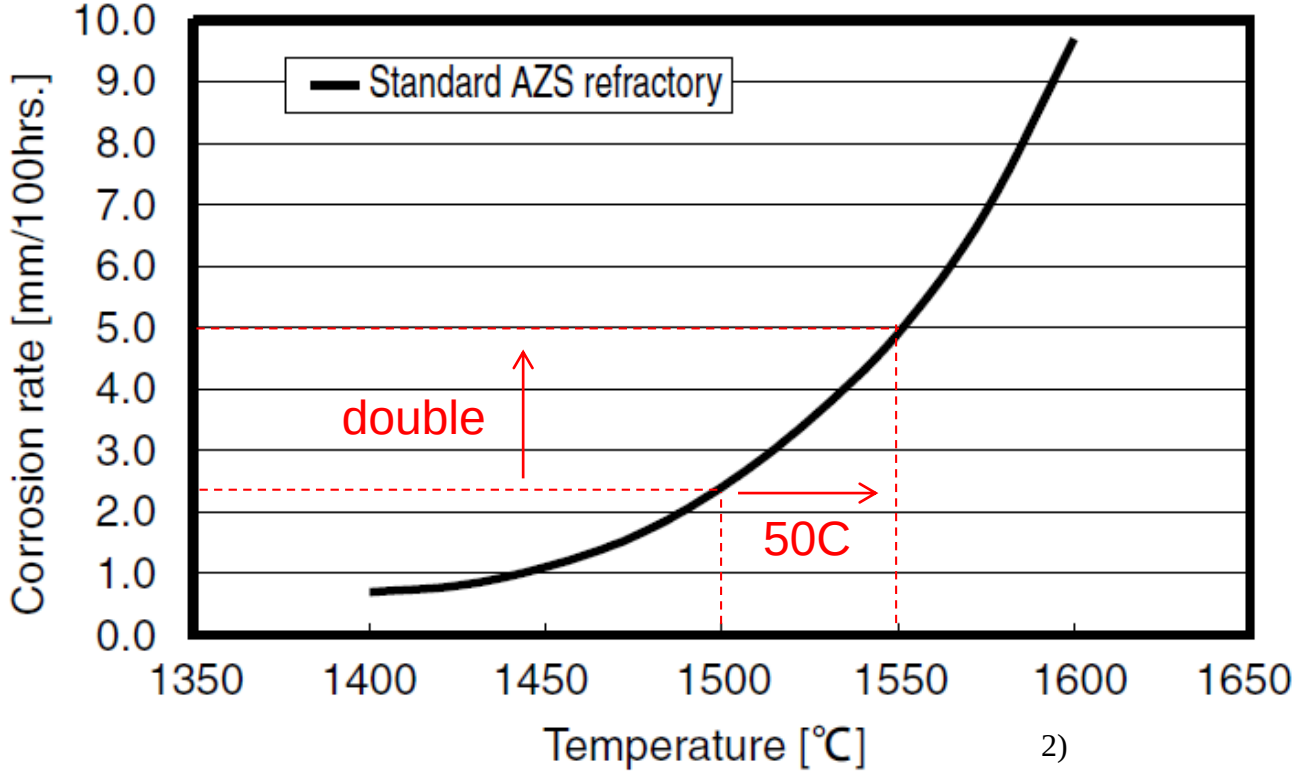
1) Glass Inter national

Corrosion Mechanism

Corrosion speed of AZS refractory at laboratory



TC-11 corrosion test.



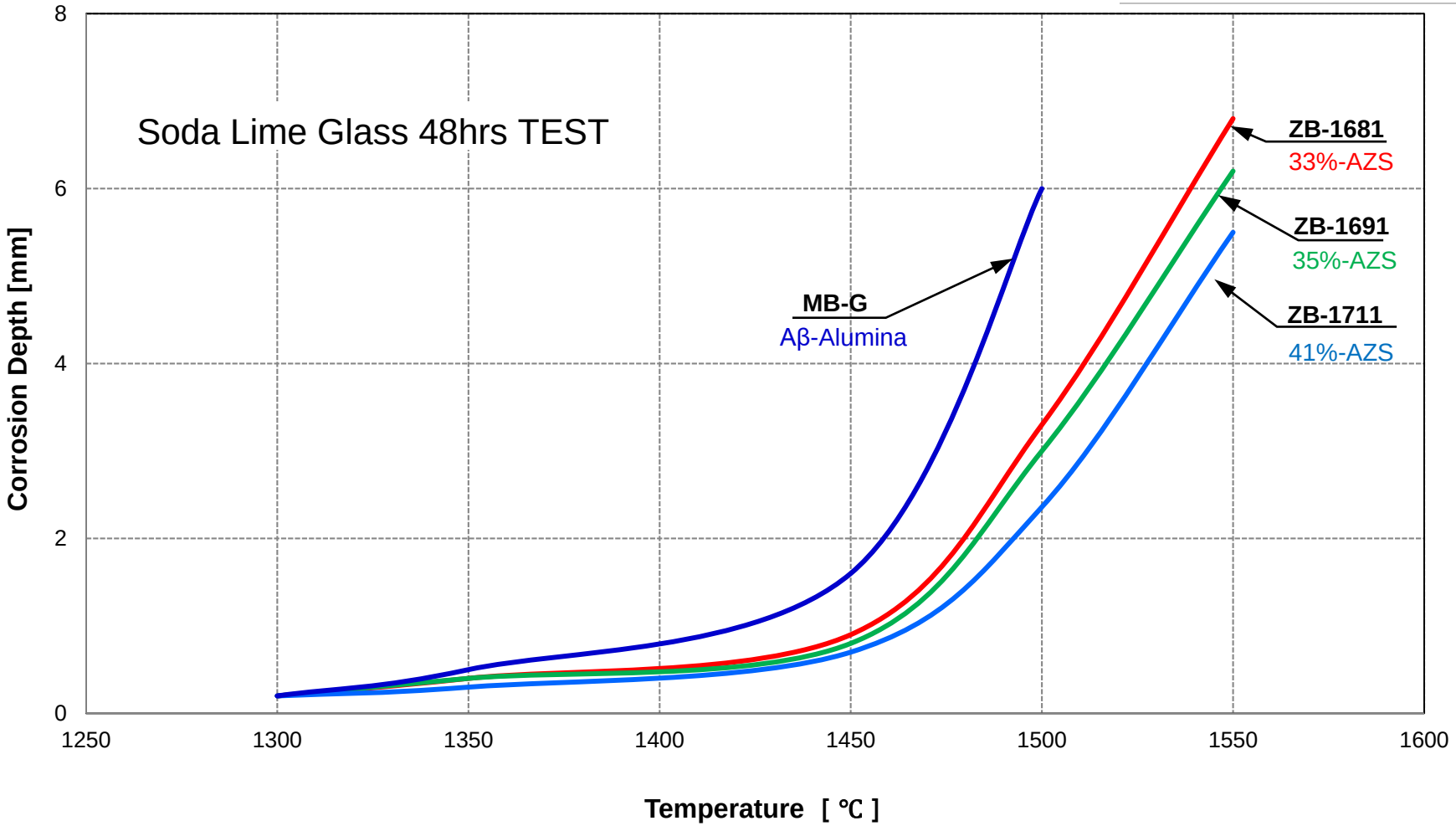
2)

Fig. 3 Refractory corrosion rate[7].

If temperature increases 50C, corrosion speed is more than double.

2) *Nishikawa et al*, Development of Numerical Prediction Model of Refractory Corrosion for Glass Melting Tank*Reports Res. Lab. Asahi Glass Co., Ltd., 55 (2005)*

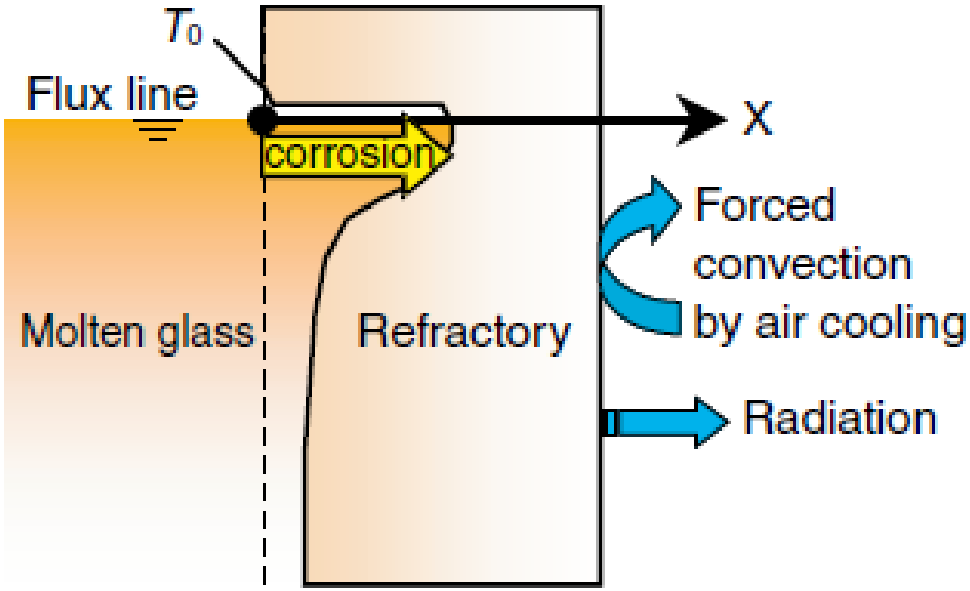
Corrosion Mechanism



Corrosion depth become more than double, with each 50 C.

AZS (= Al2O3, ZrO2, SiO2 fused cast refractory)

Corrosion Mechanism

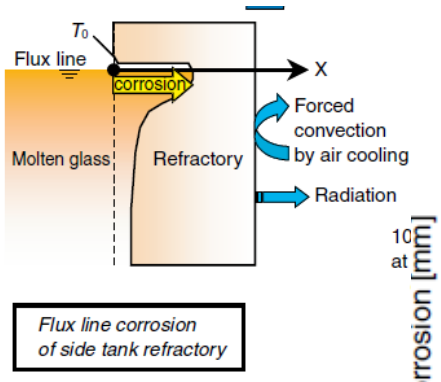


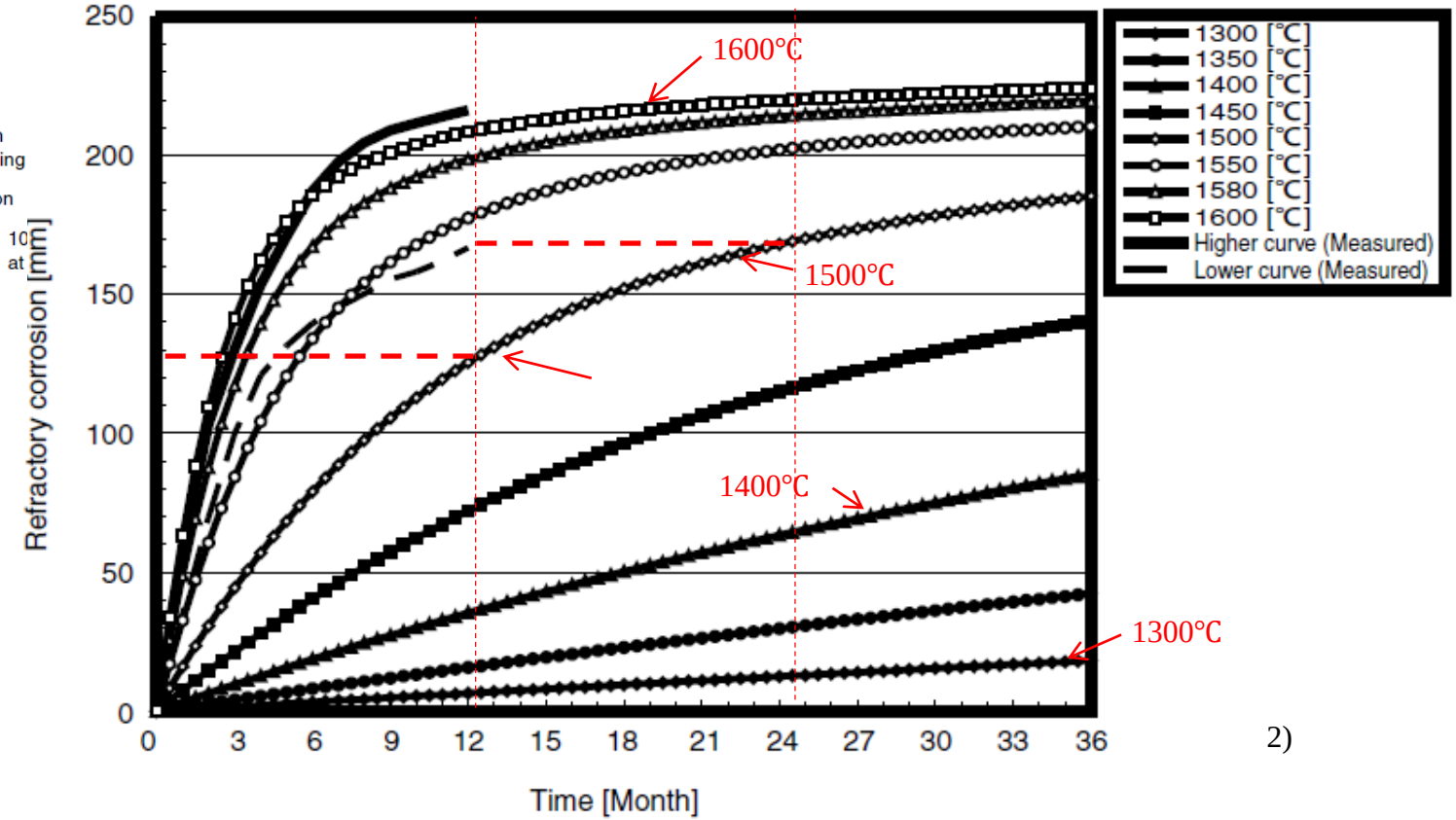
Flux line corrosion of side tank refractory

Temperature distribution of refractory affects to corrosion speed.

Corrosion Mechanism

Corrosion speed of AZS refractory at actual furnace





2)

Fig. 5 Comparison of the calculation results with reference data.

The thickness of side wall become half after 1 year in 1500C.

2) *Nishikawa et al*, Development of Numerical Prediction Model of Refractory Corrosion for Glass Melting Tank*Reports Res. Lab. Asahi Glass Co., Ltd., 55 (2005)*

Corrosion Mechanism

Conclusions

- High temperature is better for glass load,
  but sometimes it causes trouble with refractory.

- Corrosion speed of AZS refractory increases more than double, with each 50℃.

- In order to achieve high reliability and long life furnace, it is important well-balanced design and operation which are based on understanding of corrosion mechanism.

and next THIS CORRODED AZS will be ……

Cat scratch

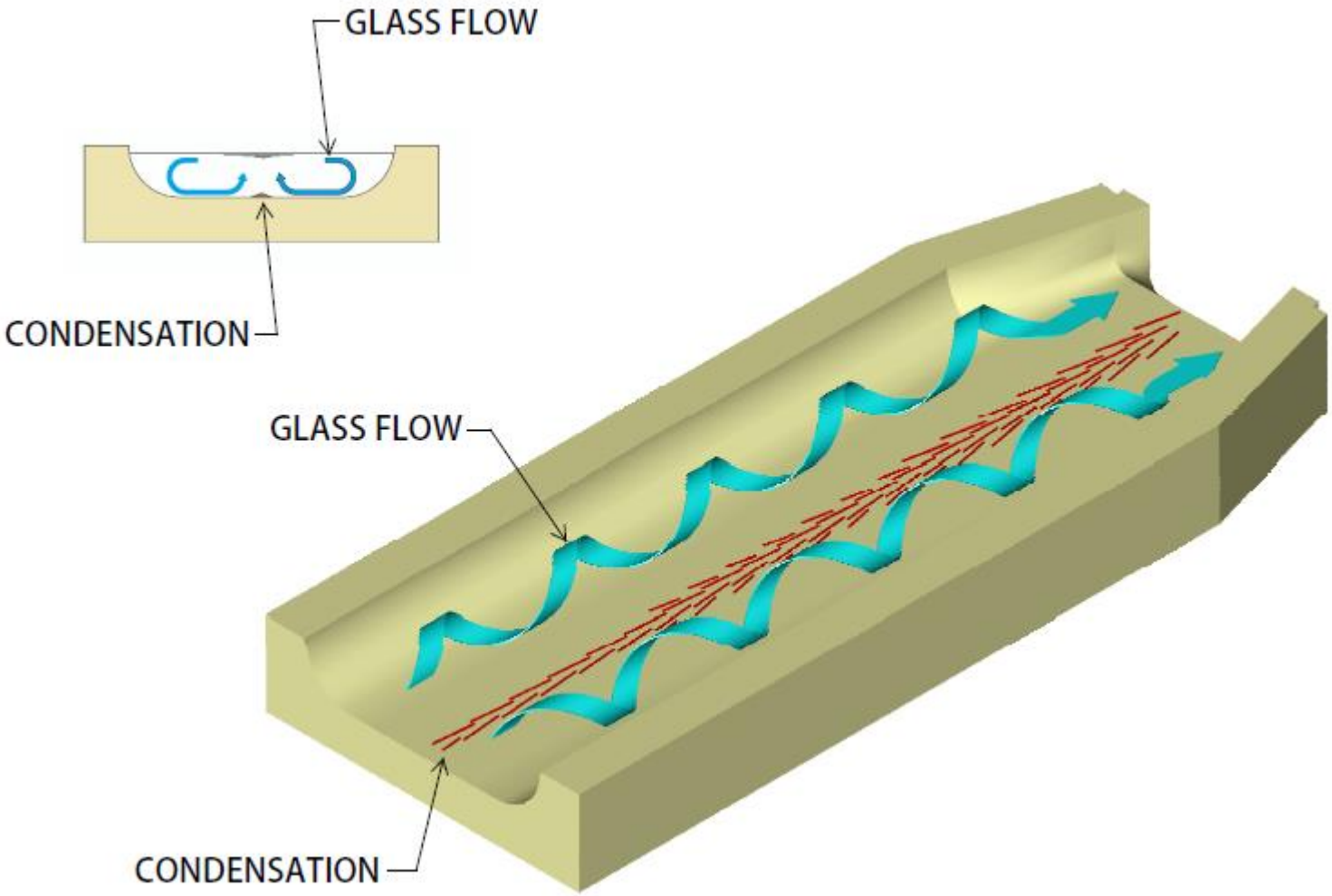
- At the glass manufacturing process, there are some kind of glass defect which affect the glass quality.

- AGC has knowledge of defects from an experience as the glass manufacturer.

- This is the basic study of glass knot which is called "Cat Scratch".

Cat scratch

Why cat scratch?



Typical Types of Cat Scratch

Ⅰ. ZrO_2 Type

- Generally from Melter Zirconia or other
- Not so strong
- Multiple knot
- Low diffusion speed

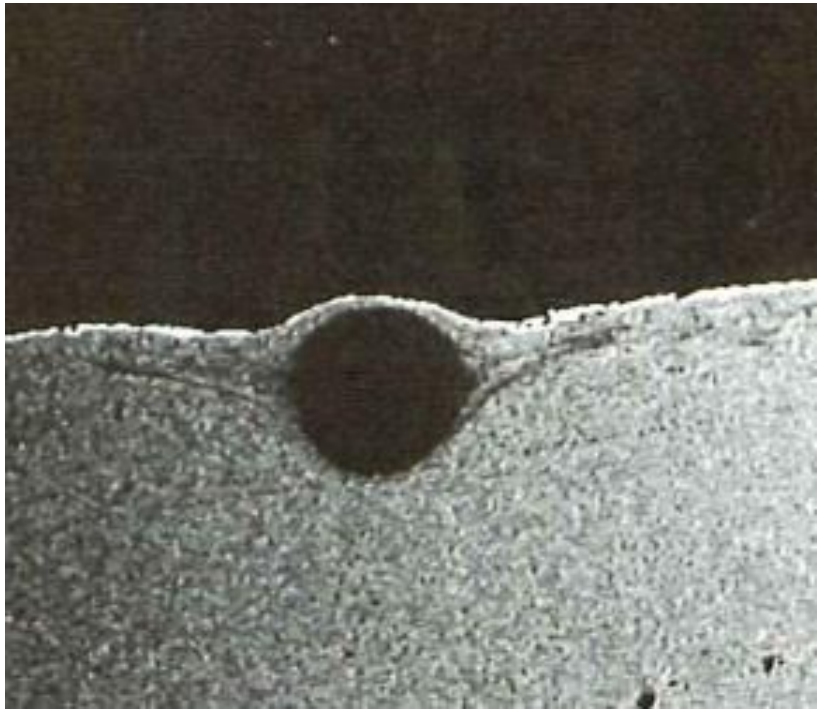
Ⅱ. Al_2O_3 Type

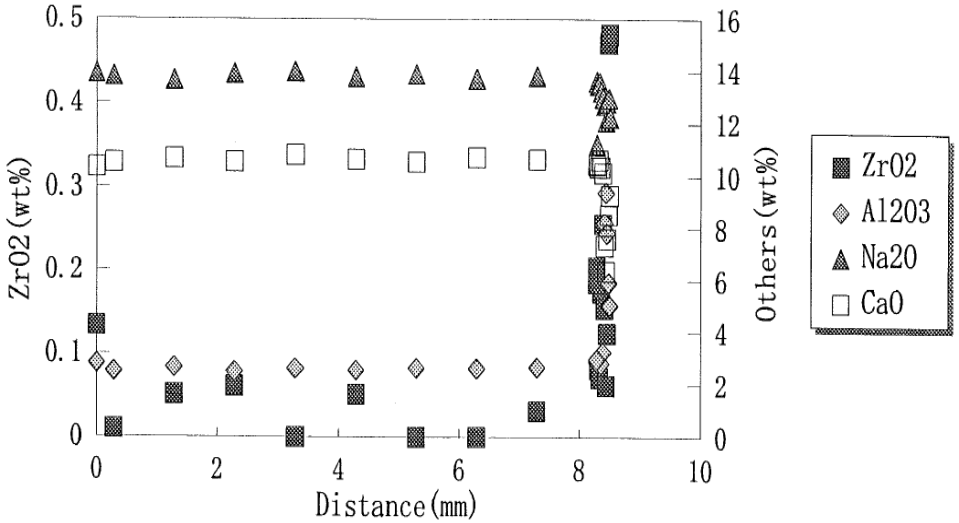
- Generally from WE, FH aluminum or other
- Strong
- Single knot
- Higher diffusion speed

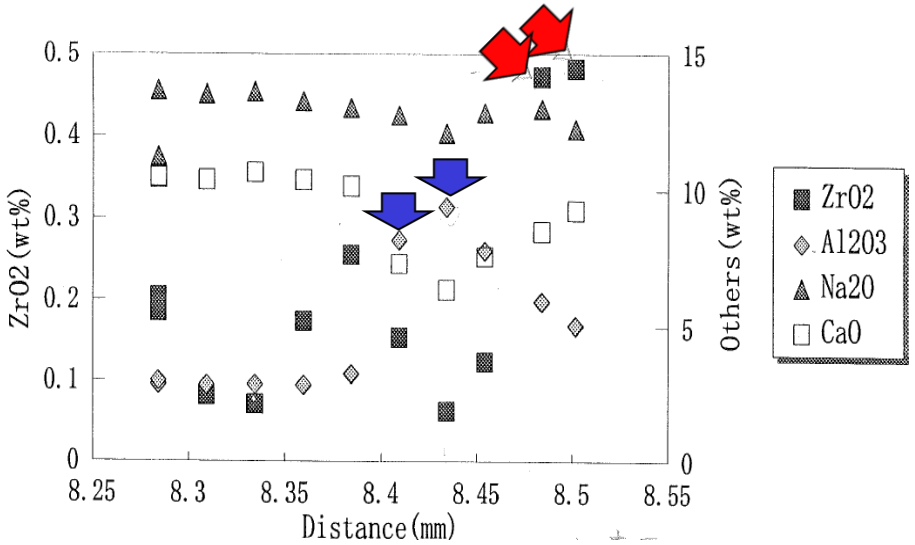
Ⅲ. Mixed Type

Case Study(Mixed Type)

Cat scratch



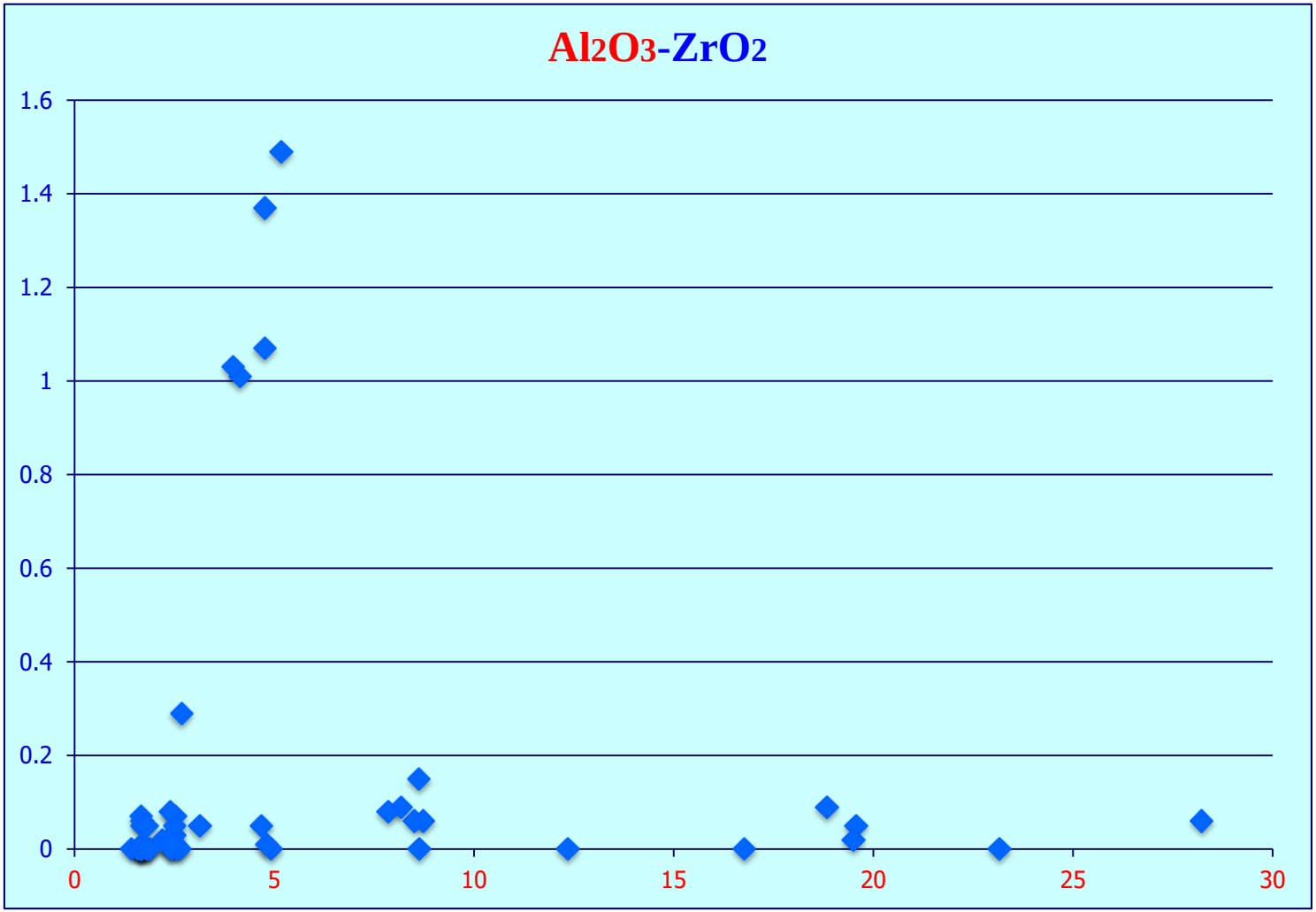




- ✓ Knot root may not be one.
- ✓ It is necessary to consider the mixed results.
- ✓ There is back ground of ZrO_2 condensation from stagnant area.

Typical Knot Pattern

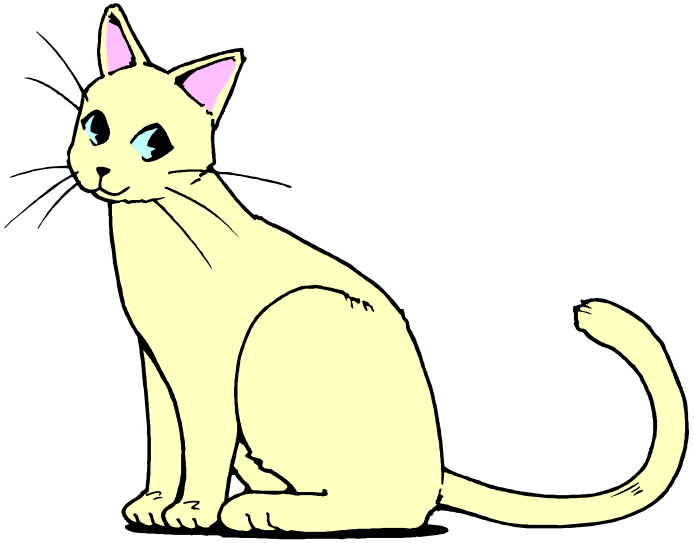
Cat scratch



How to Minimize

Cat scratch

- Minimize the stagnant
  1. Good design
  2. Keep temperature
  3. Freeze the stagnant

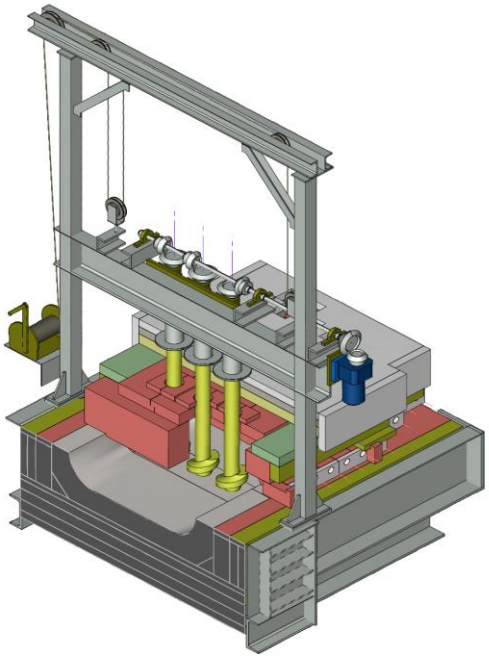


How to Minimize

Cat scratch

- Separation
  1. Drain off
  2. Catch and hold

- Mix into mother glass
  1. Stirrer
  2. Paddler
  3. Bubbling



Cat scratch

Conclusions

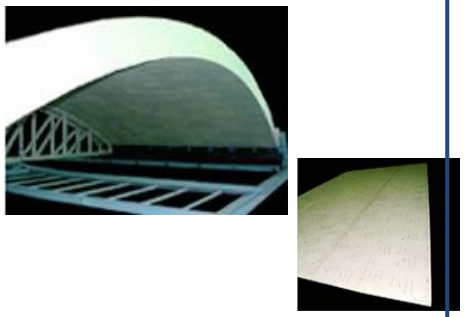
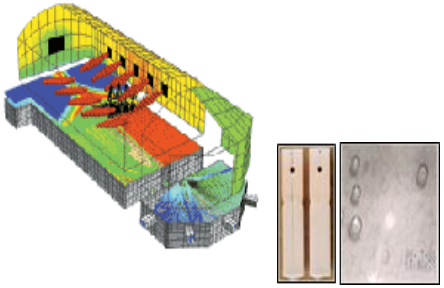
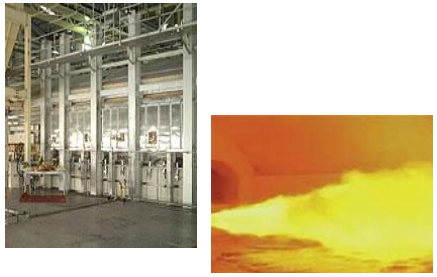
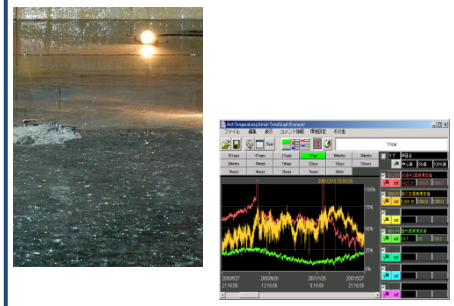
- Stagnant area is deeply related

  Stagnant is roots of cat scratch and minimize stagnant is effective for minimize
- Typical scratch are ZrO2 orAlsO2
- Stirrer is most popular solution
- ZX(High Zirconia Fused Cast Refractory)is good material for improve glass quality *NO cat scratch and Low brister*

Contribution for Glass Manufacturing

1) Energy saving

2) Glass quality improvement

Refractory	Simulation service	Furnace engineering	Knowledge and Experience
			

Conclusions

- A fundamental knowledge is important for the glass furnace performance. A good concept, for structure, material selection and innovative application, conduces to a good performance of energy saving and glass quality.
- AGCC make every possible effort to the glass industry, with proven refractory materials for 100 years and proven engineering service for 40 years. Each one of the Hyper-Regenerator™, and Thermotect-Wall™, is just a good example of the grand sum of AGCC activities.