

Silica Corrosion - mechanisms and test methods

Rongxing Bei

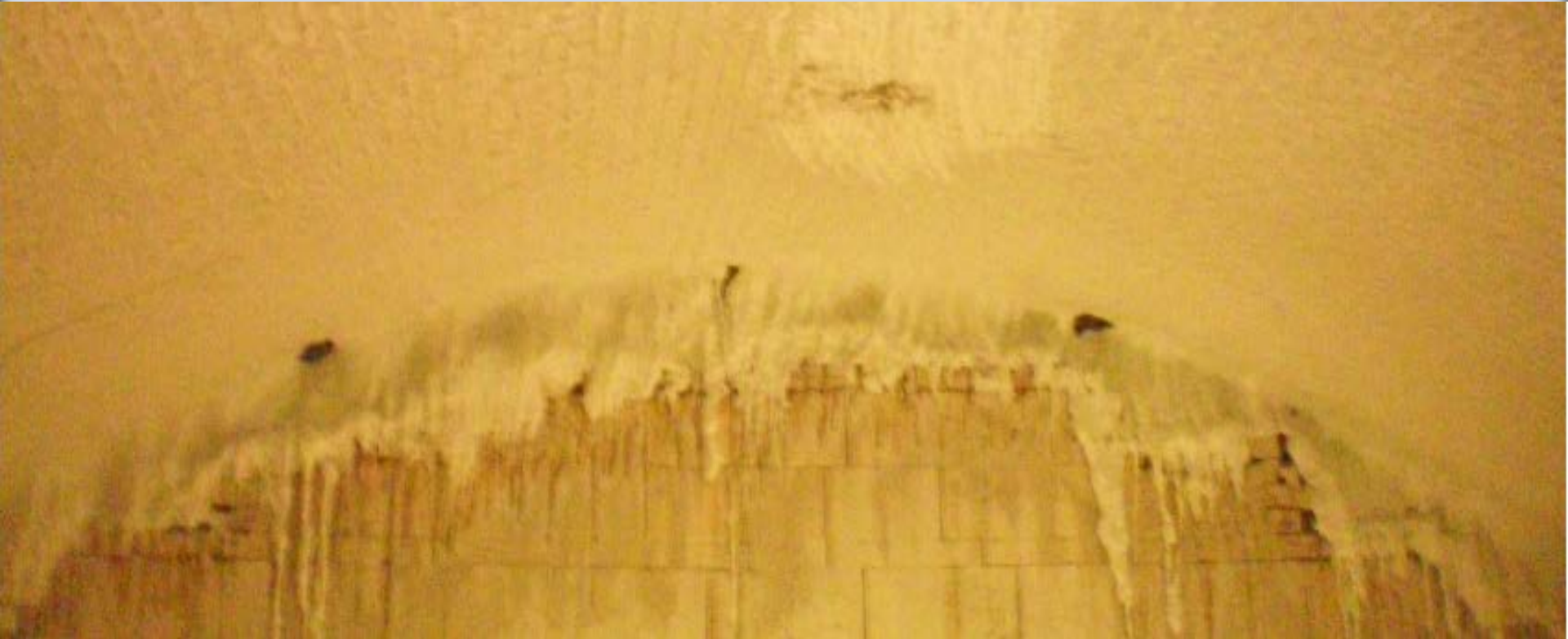
RHI Magnesita
RHI GLAS GmbH, Wiesbaden
Germany



Content

- 1 Silica Corrosion – examples from glass industry
- 2 Silica Corrosion – mechanisms
- 3 Silica Corrosion – test methods
- 4 Silica Corrosion – analysis

Silica Corrosion – examples from glass industry



Melter crown with silica:
> 10 years in oxy fuel furnace

Silica Corrosion – examples from glass industry



Silica dripping
over AZS super structure

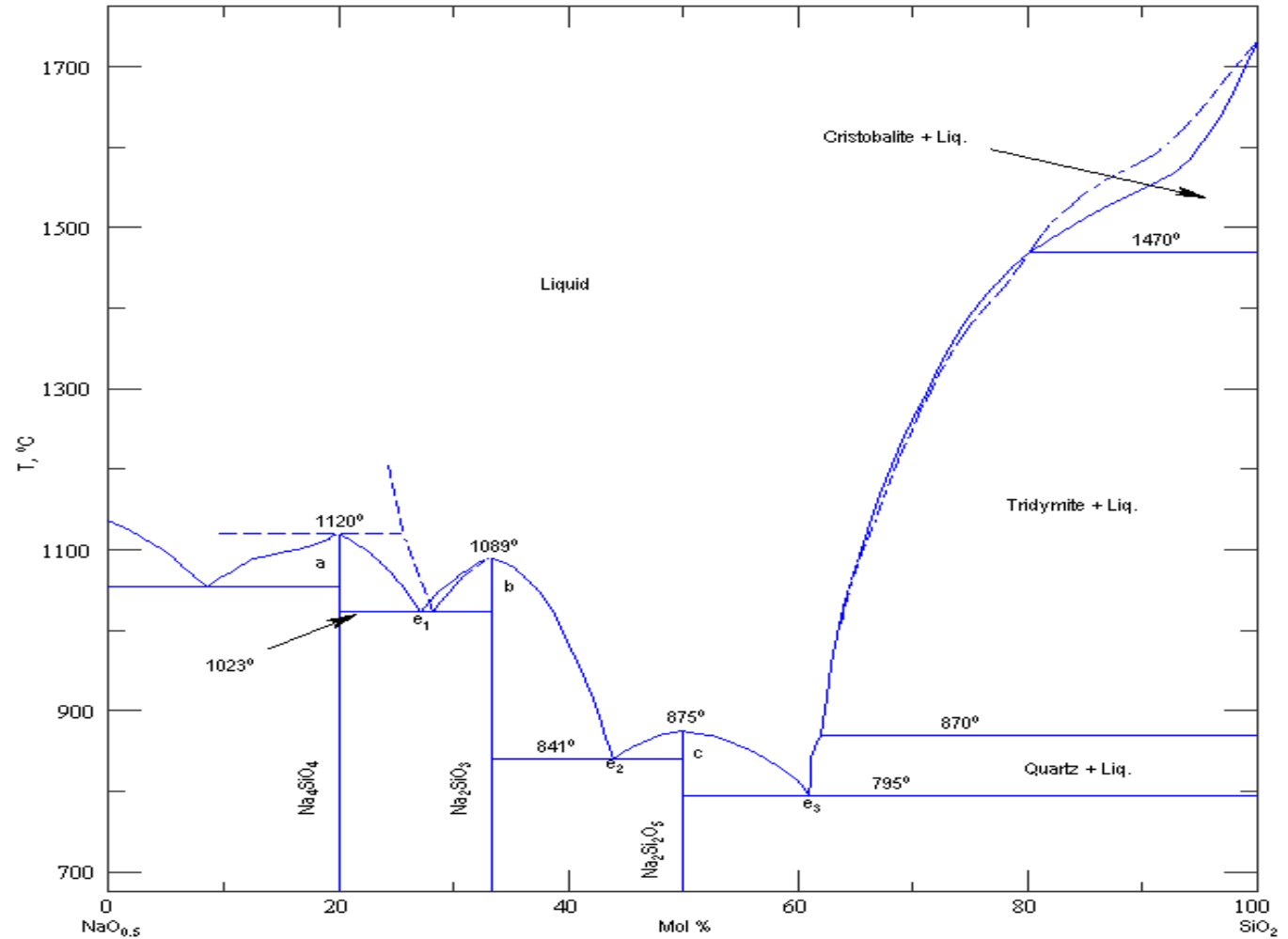
Silica Corrosion – examples from glass industry

Silica:
Regenerator target wall



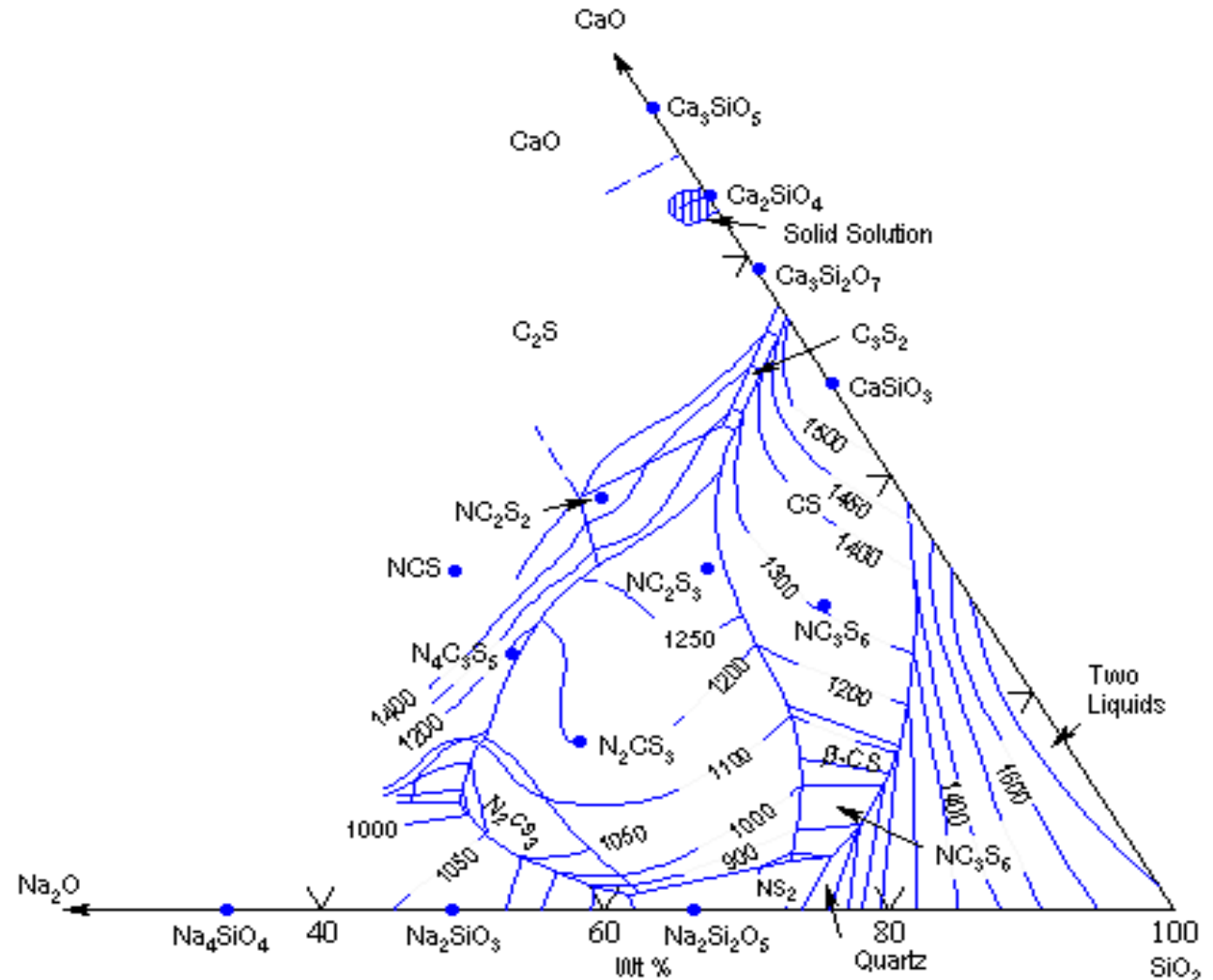
Silica Corrosion – mechanisms

System
Na₂O-SiO₂



Silica Corrosion – mechanisms

System
 $\text{Na}_2\text{O}-\text{SiO}_2-\text{CaO}$



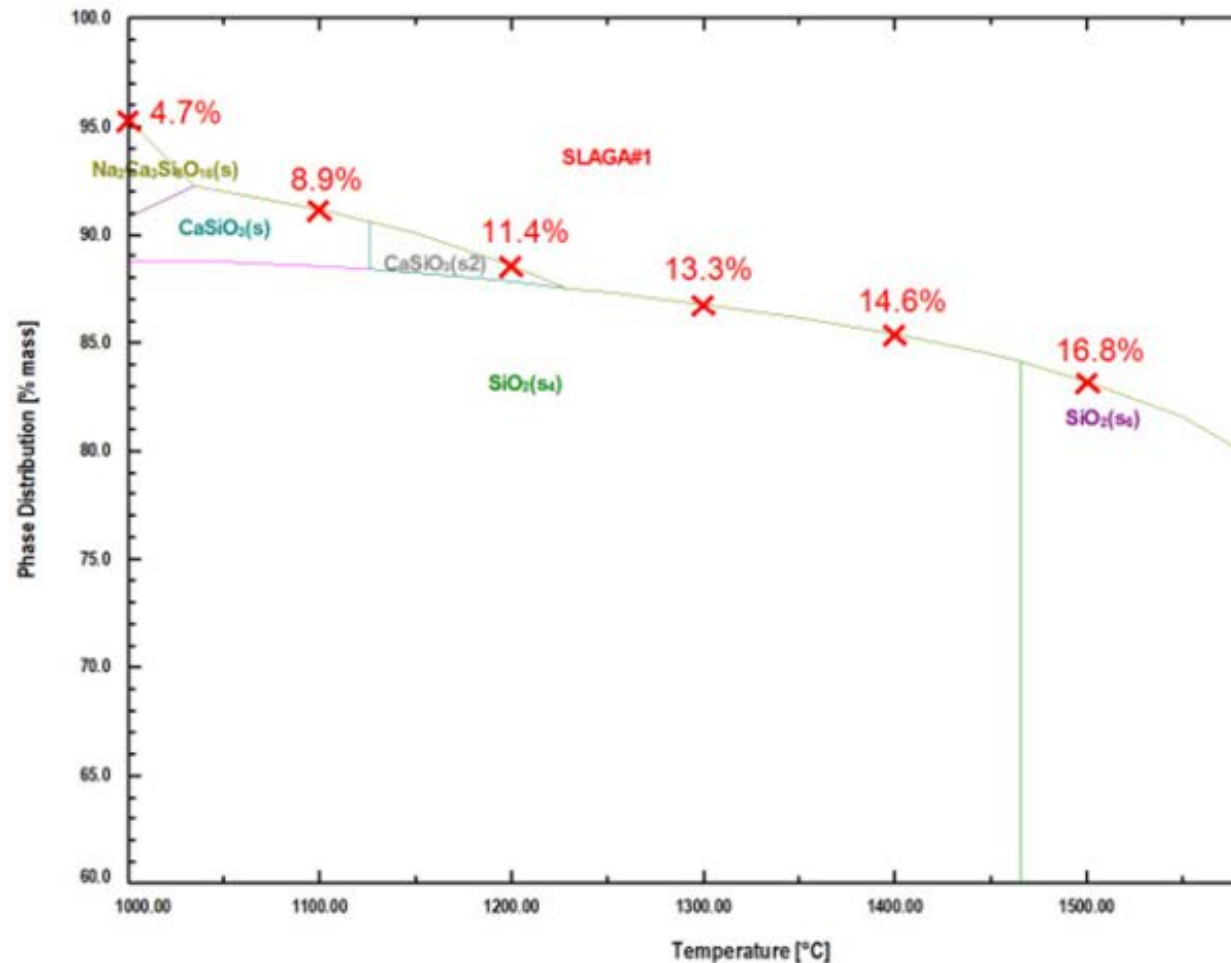
Silica Corrosion – mechanisms



Thermal dynamic calculation for standard silica:

On hot face of standard silica at 1500°C:

17% slag (if 1% Na₂O)
30% slag (if 2% Na₂O)



Silica Corrosion – test methods

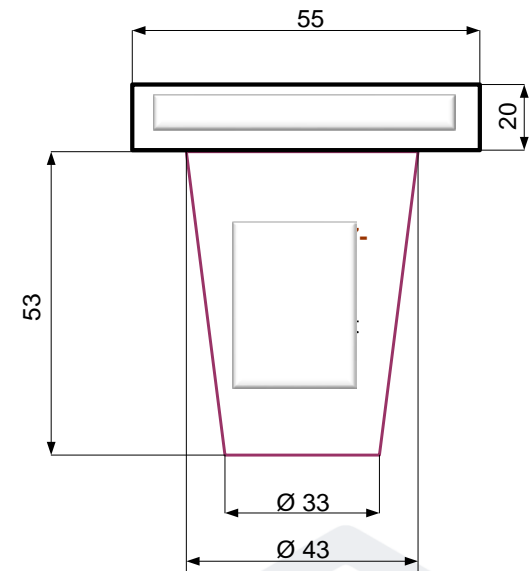
Overview

	Alkali vapour	Carryover	Furnace Atmosphere	Temperature gradient	Long time
ASTM C987	X				
2 Step Crucible Test (RHIM)	X	X			
Field test	X	X	X		
Post mortem	X	X	X	X	X

Silica Corrosion – test methods

ASTM C987

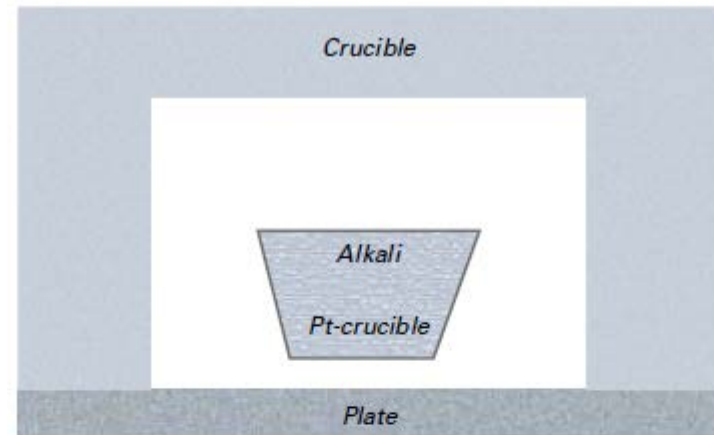
Standard Test Method
for Vapor Attack on Refractories for
Furnace Superstructures



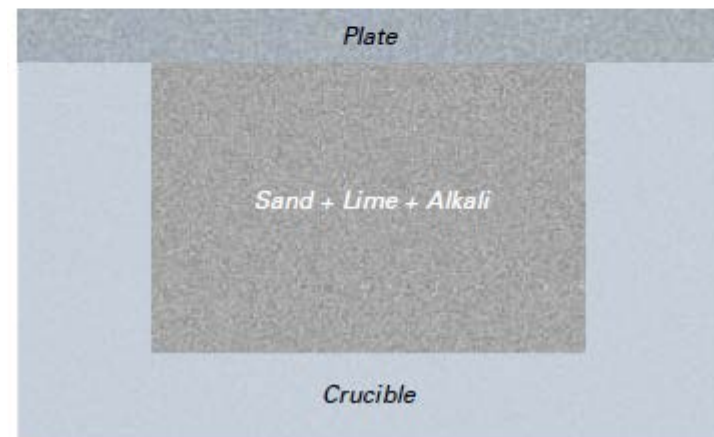
Silica Corrosion – test methods

2 Steps Crucible Test

- Until now test for regenerator materials
- Can be done for silica bricks



First step: Na_2CO_3 and Na_2SO_4 (1370 °C)



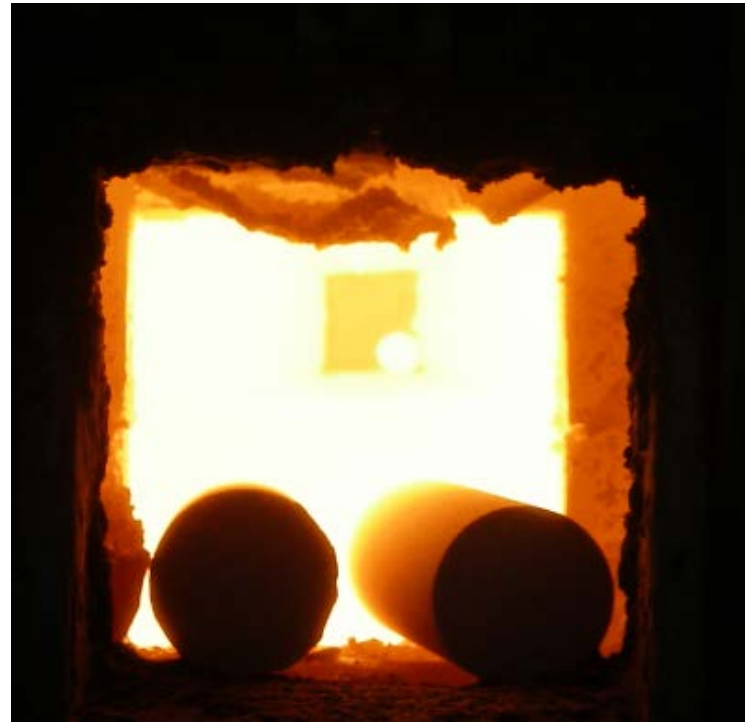
Second step: Sand, lime, Na_2CO_3 , and Na_2SO_4 (1470 °C)

Silica Corrosion – test methods

Field test:

standard silica
vs No-Lime Silica

- Oxy- Fuel
- Superstructure



Silica Corrosion – test methods

Crown block
(standard silica)



Post mortem



Silica Corrosion – Analysis

- Standard Silica

Field test



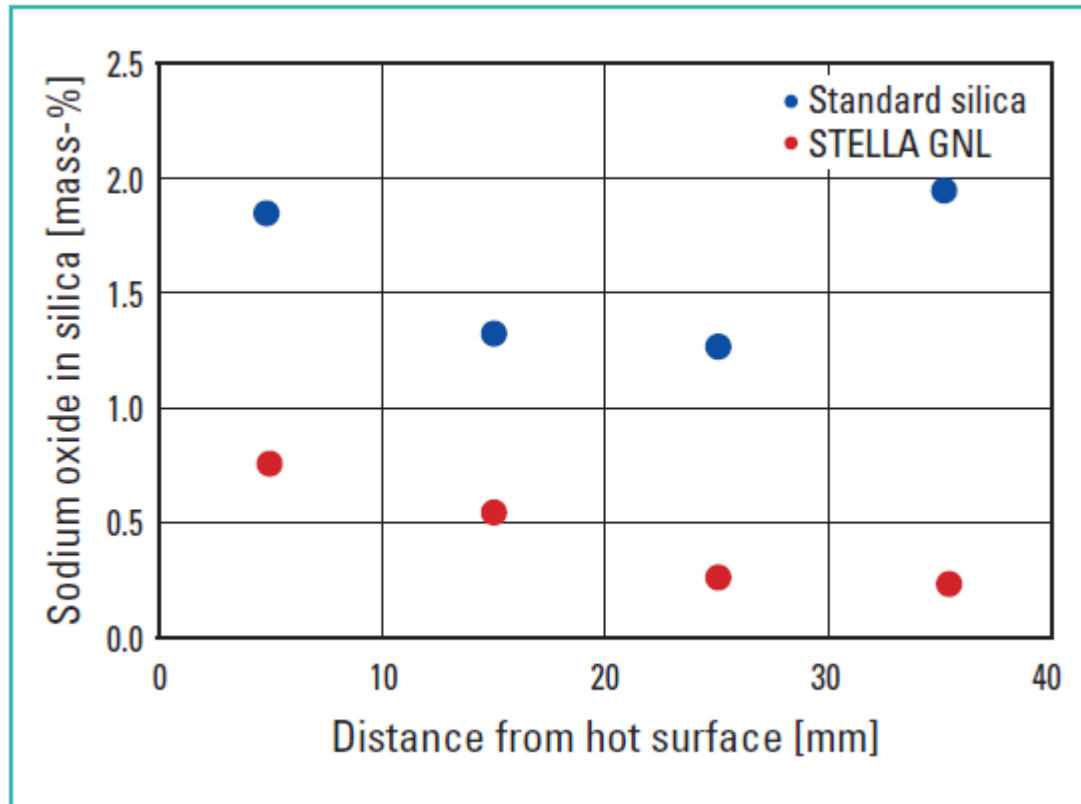
- silica without lime bonding



Silica Corrosion – Analysis

absorption
of alkali

Field test



Silica Corrosion – Analysis

Post mortem

Brand		0-30 mm	140-160 mm
<u>Chemical Analysis:</u>			
Loss on ignition	% by wt.	0,23	0,31
Oxides after ignition ¹⁾			
Na ₂ O		0,43	1,29
Al ₂ O ₃		0,46	0,59
SiO ₂		98,1	94,0
SO ₃		0,10	0,02
K ₂ O		0,04	0,11
CaO		0,72	3,51
Fe ₂ O ₃		0,09	0,40
ZrO ₂		0,02	< 0,01

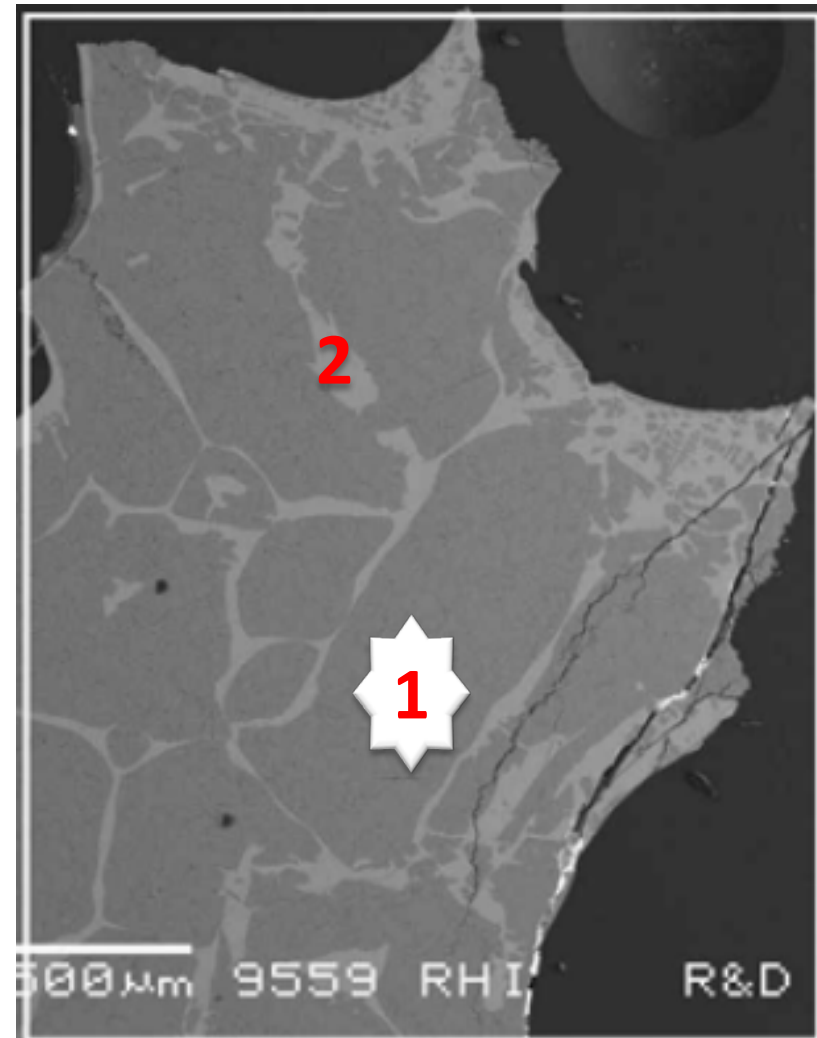
Silica Corrosion – Analysis

Post mortem

Hot face 1:

„glassy phase“ with CaO

	Na ₂ O	MgO	Al ₂ O ₃	SiO ₂	K ₂ O	CaO
1				100		
2 - glassy phase	6,7	0,8	1,7	68,6	0,9	20,2

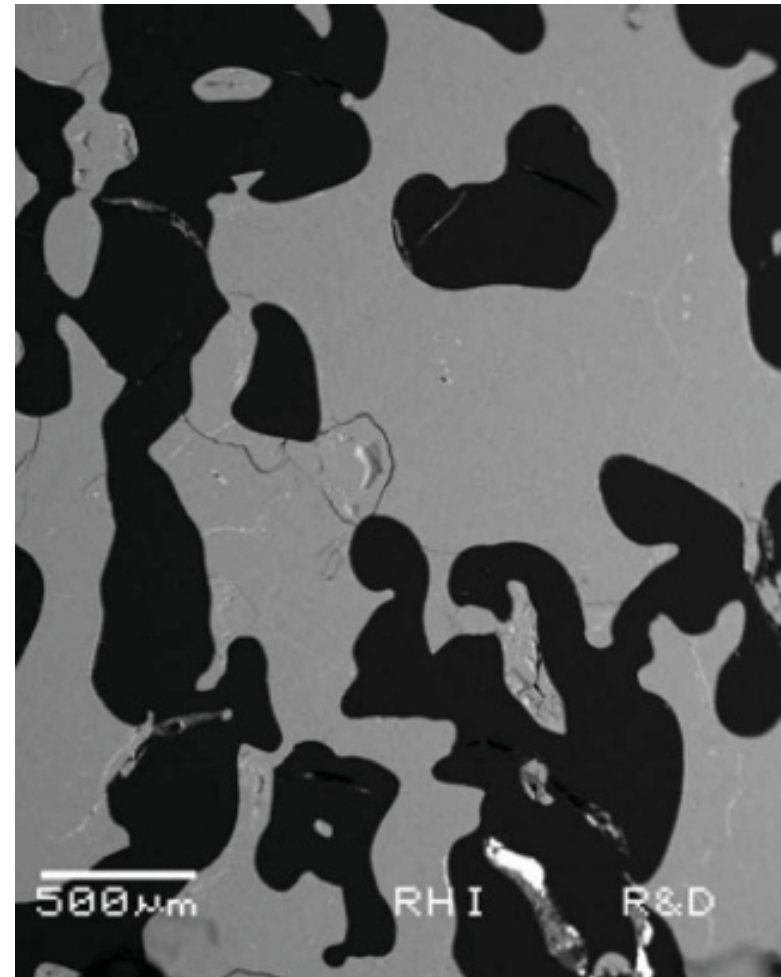


Silica Corrosion – Analysis

Post mortem

Hot face 2:

- Glassy phase already dripped out
- SiO_2 crystal islands remain



Final Question

Which methods do you like?

	Alkali vapour	Carryover	Furnace Atmosphere	Temperature gradient	Long time
ASTM C987	X				
2 Step Crucible Test (RHIM)	X	X			
Field test	X	X	X		
Post mortem	X	X	X	X	X

Get in touch

RHI MAGNESITA

RHI GLAS GmbH
Hagenauer Straße 53-55a
65203 Wiesbaden – Germany
Phone: +49 611 2365 297
E-mail: glass@rhimagnesita.com
rhimagnesita.com

Important notice:

These materials do not constitute or form part, or all, of any offer of invitation to sell or issue, or any solicitation of any offer to purchase or subscribe for, any securities in any jurisdiction in which such solicitation, offer or sale would be unlawful, nor shall part, or all, of these materials form the basis of, or be relied on in connection with, any contract or investment decision in relation to any securities.

These materials contain forward-looking statements based on the currently held beliefs and assumptions of the management of RHI Magnesita N.V. or its affiliated companies, which are expressed in good faith and, in their opinion, reasonable. These statements may be identified by words such as “expectation” or “target” and similar expressions, or by their context. Forward-looking statements involve known and unknown risks, uncertainties and other factors, which may cause the actual results, financial condition, performance, or achievements of RHI Magnesita N.V. or its affiliated companies to differ materially from the results, financial condition, performance or achievements express or implied by such forward-looking statements. Given these risks, uncertainties and other factors, recipients of this document are cautioned not to place undue reliance on these forward-looking statements. RHI Magnesita N.V. or its affiliated companies disclaims any obligation to update these forward-looking statements to reflect future events or developments.

