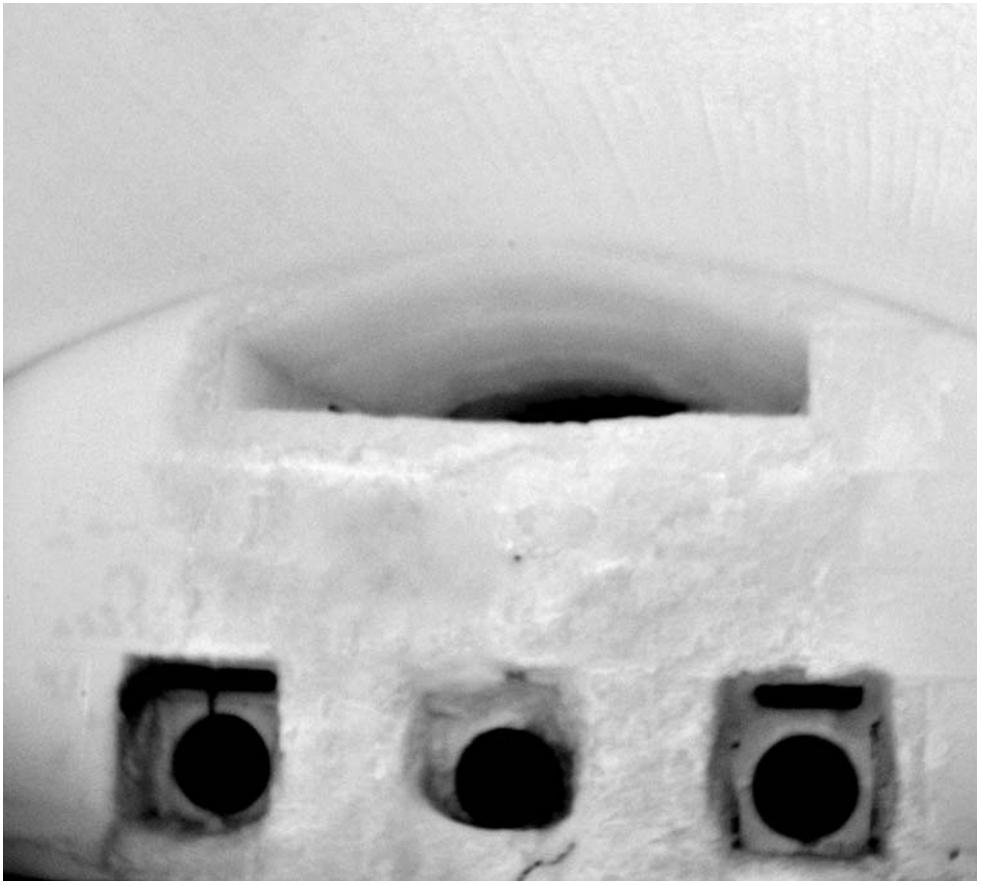
The name for competence in ceramic welding in the glass industry

FUSETECH
INTERNATIONAL G.m.b.H.

Technical advances now also allow application in the steel, coking, aluminium, copper, foundry and cement industries

Member of the SKS Group

Burner wall before welding



Burner wall after welding

THE BACKGROUND

The process of ceramic welding was developed in the late 1960s by a Belgian glass manufacturing company. The technology was introduced in the United States In 1979 as an effective method for carrying out a wide range of repairs during furnace operation.

Skewback and crown melting end

ADVANTAGES

The key benefit of ceramic welding is that it can be performed during normal furnace operation. As it is not necessary to stop or cool down the furnace production losses are minimised or even avoided completely. In view of the very high costs involved in even a partial reconstruction, ceramic welding is an attractive method of extending furnace life.

Most of the glass manufacturers who make use of ceramic welding do so in order to prolong the life time of the furnace refractories without loss of production. Users include manufacturers of flat glass, containers, glass fibre, sodium silicate and other special glasses.


FUSETECH

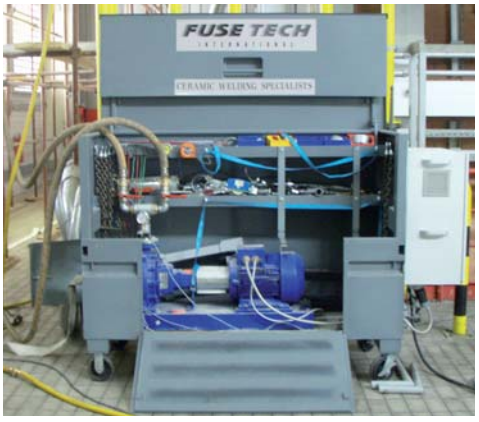
CERAMIC WELDING

For the ceramic welding process a dry mixture (the welding material) is transported by a pneumatic material pump into the furnace during normal operation. The pump consists of a stainless steel housing with a filling shaft for the material mixture, compressed air and oxygen connections and an outlet for the oxygen-batch mixture.

The batch is passed to the injector pump by means of a compressed air-driven metering shaft to which a mixing paddle is also attached. An oxygen pressure of approx. 6 bar is used to transport the material through a hose to a special water-cooled welding lance. The complete machine is certified by the appropriate German Inspection Agency (TÜV).

Welding machine

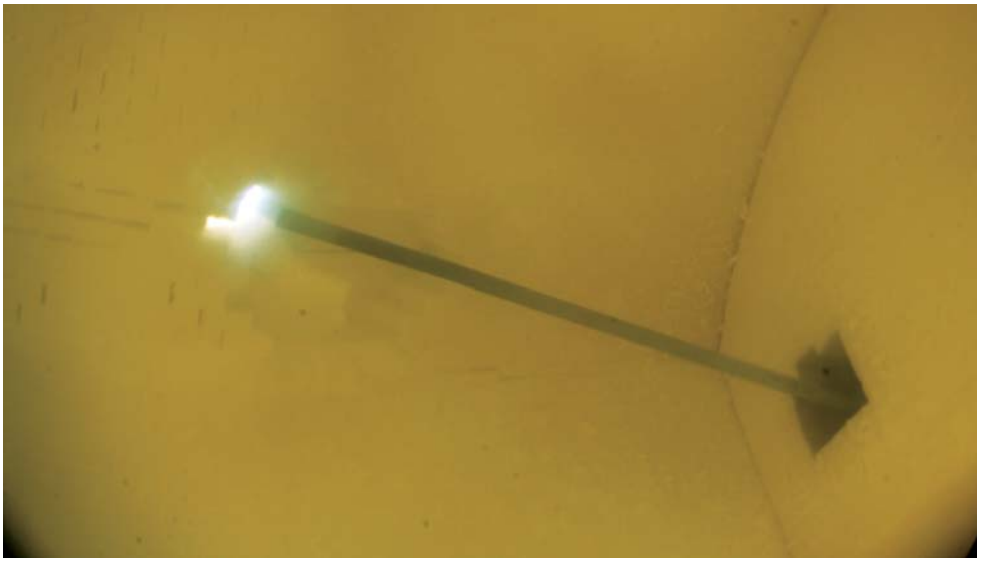
Welding lance



Water pump station

Many different lance designs and sizes are available making it possible to work on damaged areas in the furnace that are normally difficult to reach. These include the crown, port necks, burner arches and doghouse arches.

The stream of welding mixture enriched with oxygen comes into contact with the hot refractory surface causing the metallic components in the welding mixture to oxidize. This leads to a highly exothermic reaction. The heat developed (temperatures reach between 1600 and 2200 °C) fuses the refractory material and the welding mixture, and so it is possible to repair even large area damage. The reaction results in a long-lasting bond between the two materials.



Crown welding

Corner and skewback before welding

Corner and skewback after welding

Tuckstone area before welding

Tuckstone area after welding

WELDING MATERIALS AND COMPOSITIONS

The following materials are available for the repair, depending on the part of the furnace to be treated:
HWC-Al-1, an alumina based material
HWC-S-1, a silica based material
HWC-AZS-1, a material based on AZS.

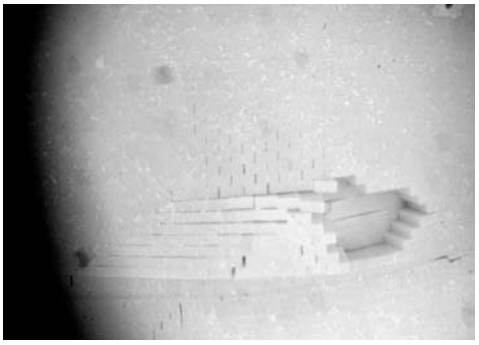
In addition, for the glass industry:
HWC-S-2, a welding material based on silica, used for the maintenance and repair of silica refractories.

HWC-AL-1
Ceramic welding material based on alumina, mainly used for nose rings in cement furnaces, cyclones and in the glass industry

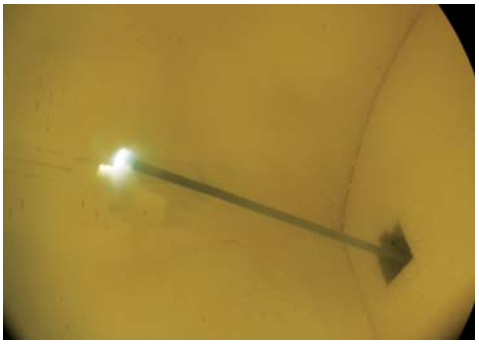
Al_2O_3	ca. 72%
SiO_2	ca. 27%

HWC-AZS-1
Aluminium based AZS ceramic welding material, mostly used for aluminium furnaces and in the glass industry

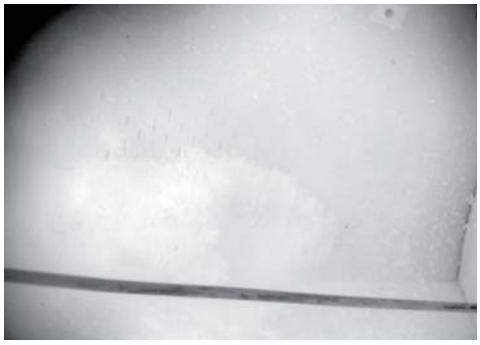
SiO_2	ca. 38%
Al_2O_3	ca. 37%
ZrO_2	ca. 20%



Inspection of regenerator crown



Regenerator crown during welding



Inspection of regenerator crown after welding

Regenerator crown after cooling down

Joints after cooling down

HWC-FC-1
Ceramic welding material based on fireclay, used in the coking and glass industries

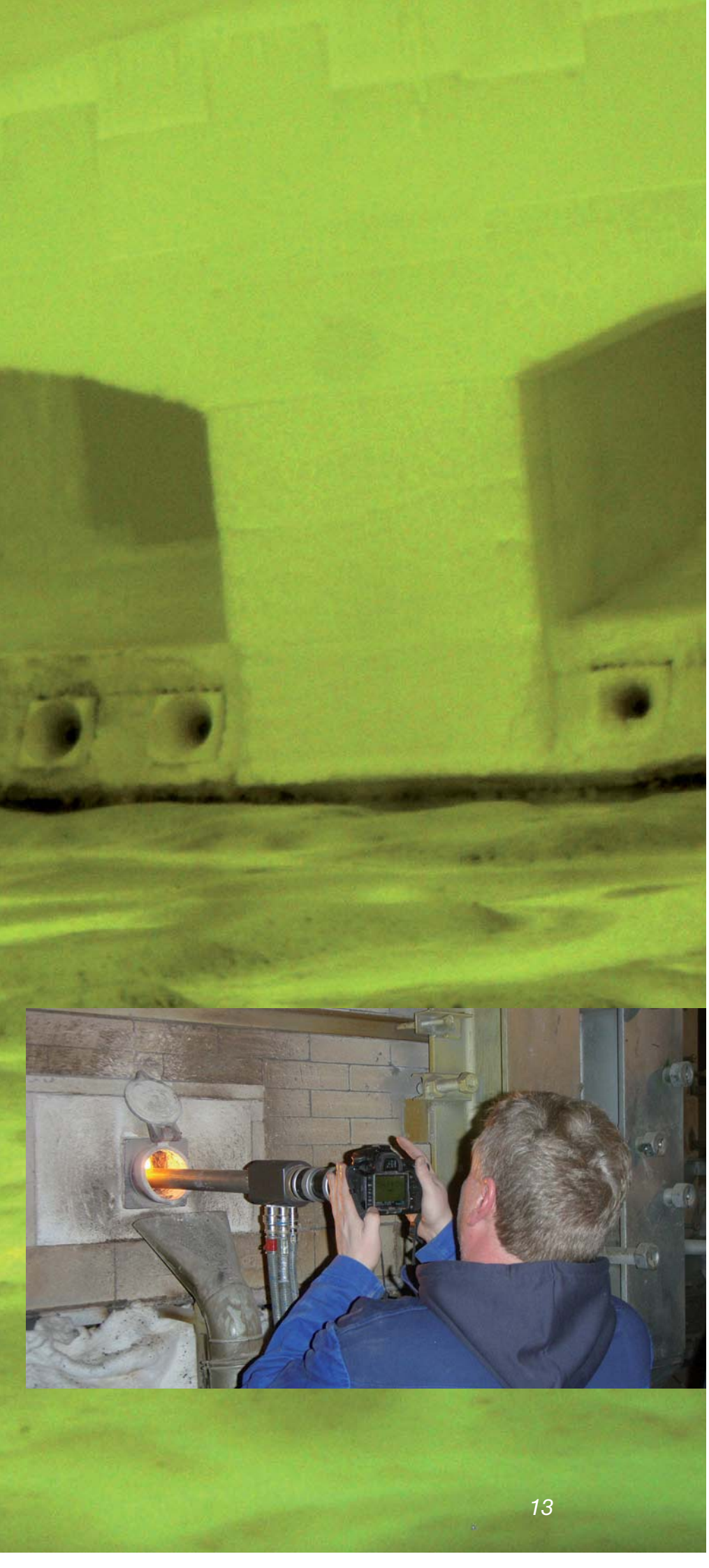
Al_2O_3	ca. 68,8%
SiO_2	ca. 27,4%

HWC-S-1
Ceramic welding material based on fused silica, used in the coking and glass industries.

SiO_2	ca. 94,3%

HWC-S-2
Material based on high purity fused silica, mainly used in the coking and glass industries.

SiO_2	ca. 98,3%



FUSE TECH
INTERNATIONAL G.m.b.H.

INSPECTION

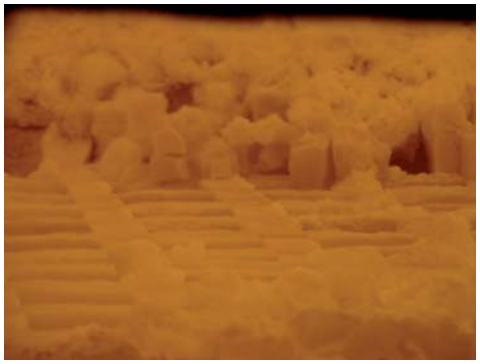
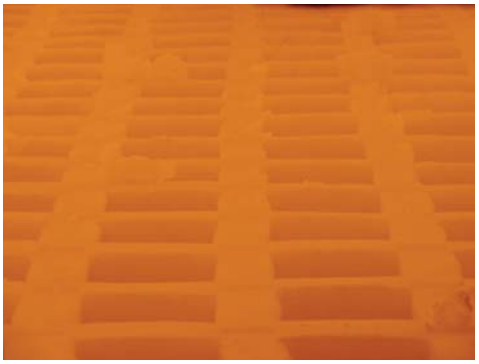
A furnace periscope is used before the welding work is begun in order to determine the extent of the damage so that the exact work needed can be agreed with the customer. The periscope can be used to provide views into difficult corners so that the work can be carried out by reference to the monitor if necessary. After the work is completed it can be used to present the results obtained.

Pictures or videos taken at regular intervals can provide the customer management with an appraisal of the furnace condition over the complete life of the furnace.

SERVICE OPENINGS

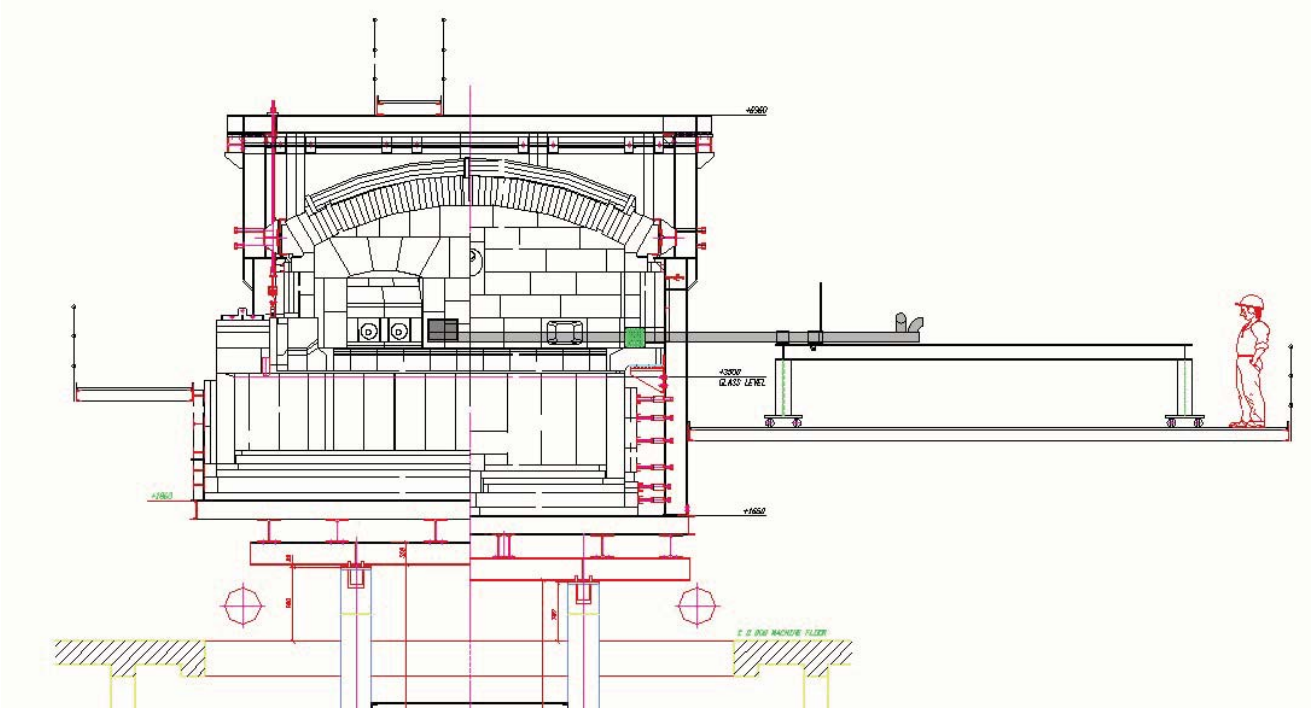
Fuse Tech has the necessary equipment and experience to cut openings in the refractory walls or crown. Clean access openings are cut with a water-cooled diamond-tipped chain saw at the most convenient locations for the work to be carried out. When the work is finished these openings are closed or configured as additional peep holes. Closing and sealing is achieved by cold face welding.



REGENERATOR AND PORT NECK CLEANING

Cleaning is recommended as soon as deposits start to have a negative effect on the combustion system. Deterioration in the combustion air or waste gas distribution can influence flame development and result in increasing CO or NO_X values and energy consumption. We use special equipment to melt and remove deposits in order to improve the efficiency of the combustion system.



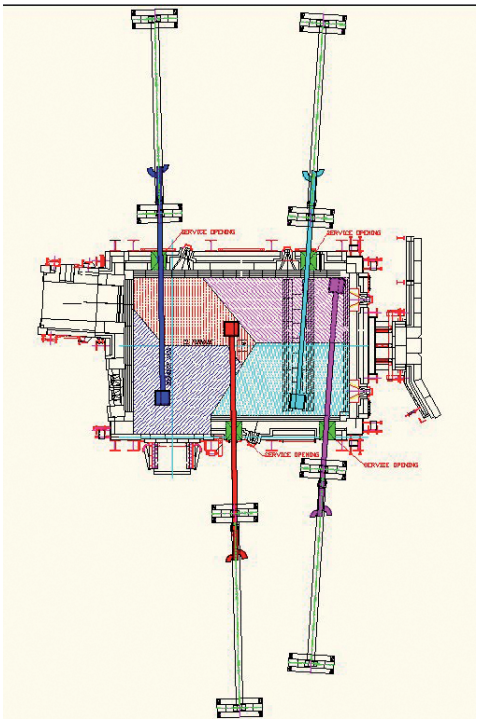
THE USE OF GRANULATE TO REPAIR CORROSION DAMAGE TO THE FURNACE BOTTOM

Early detection of problematic locations in the furnace bottom (low remaining refractory thickness) is still difficult. Test drillings are made in the bottom to determine the remaining thickness of the refractory. Problem areas are most frequently found near boosting and bubbling systems.

Depending on the furnace type, fused cast or chrome based material is introduced into the furnace chamber by our special water-cooled carriage.

As a result of our experience we can judge the amount and distribution of the granulate required and place it in the damaged area. Generally we try to disturb the production as little as possible. In certain cases different procedures may be required, and these will be discussed in detail with the customer.

This repair method is a further attractive way of prolonging furnace lifetimes at a relatively low cost.



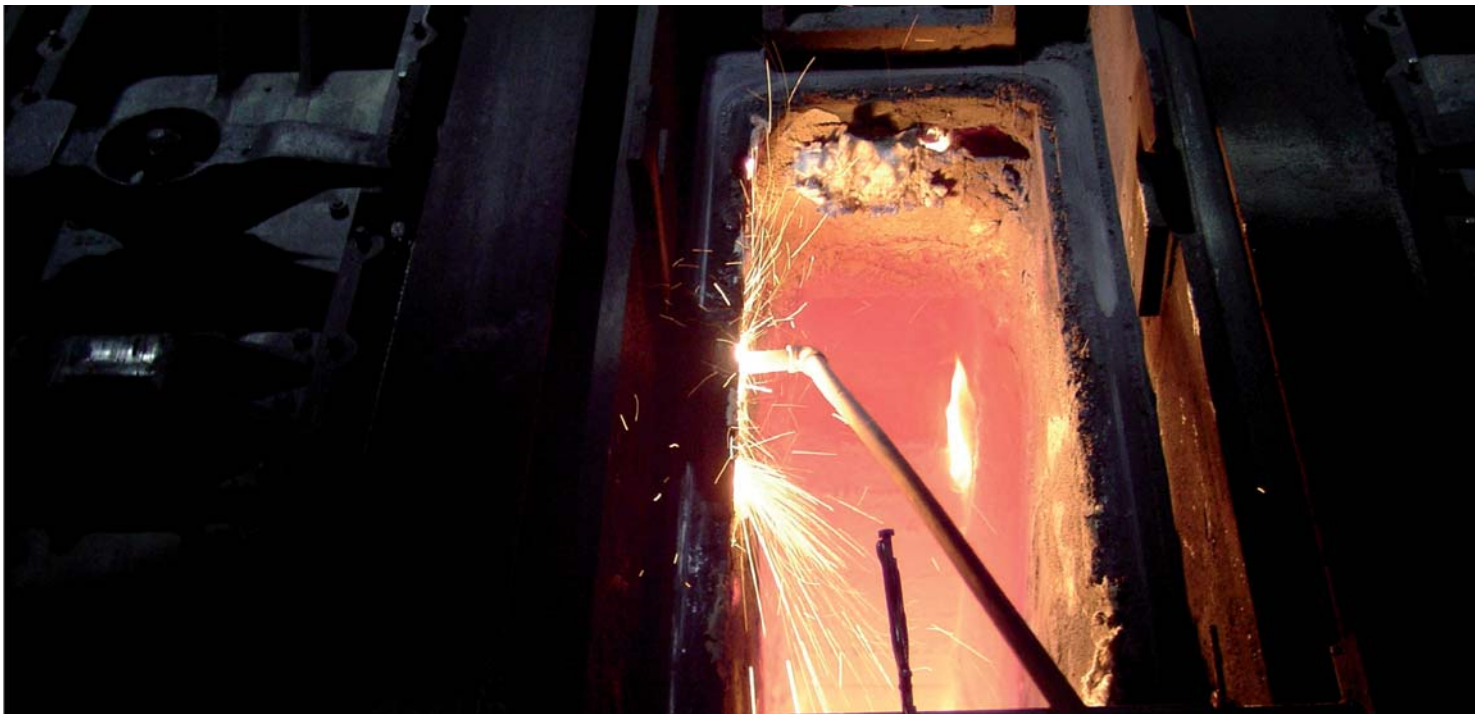
THERMAL CLEANING OF WASTE GAS CHANNELS IN RECUPERATIVE SYSTEMS

We are able to melt out solidified slag to make it fluid for draining using our thermal separation (oxygen lancing) procedure. During thermal separation oxygen is applied and the core lance tip burns. The resulting chemical reaction releases intense heat (temperatures up to 2500 °C), which is used to cut through various materials such as iron, alloyed steel scrap, refractory bricks, mortar and natural stone.

For effective and economic use it is essential that the core lance provides optimum burning characteristics according to the requirements. Our lances are noted for:

- concentrated flame bundling which provides a concentrated energy release
- long burning period and burning capacity per lance
- low oxygen consumption
- high safety level for the user
- high wind stability of the cutting flame and therefore precise positioning
- low vibration and low noise level during use

CERAMIC WELDING FOR COKE OVEN



THE PROCESS

Ceramic welding is applied by conveying a dry mixture of refractory aggregate and oxidizable particles together through stainless steel lances and if need be, through specially designed water-cool lances. Many different lance sizes and configurations can be utilized to reach damaged areas inside the furnace or vessel. The oxygen rich stream of powder contacts the hot furnace lining where the metals oxidize during a highly exothermic reaction. Enough heat is produced (between 2200 and 2500°C) by the combustion of the metals to melt the surface area of the refractory particles in the mixture as well as the surface of the damaged refractory lining substrate.

When the reaction zone is moved to another area or stopped all together the temperature of the repair area returns back to the normal operating temperature. This process creates a long-lasting, durable bond between the weld mass and the substrate giving extraordinary long life to the repair area.

SURFACE PREPARATION FOR COKE OVEN WALLS

Before ceramic welding is performed on coke oven walls it is vital that the area being repaired is properly prepared. To achieve this the technicians use a pneumatic chipping hammer to remove the major portion of the carbon, deteriorating, weak, or loose brick and any other foreign matter from the area being repaired. To assure that all carbon has been removed the technician blows oxygen over the area to be repaired to make certain that the substrate is in fact carbon free. This step is essential for the welding material to be fused to a properly prepared surface. Otherwise the material will not perform as required and subsequently lead to premature failure of the repaired area.

Another method of wall preparation is the use of sand blasting equipment. The down side to this method is that the operator can not differentiate between good refractory and bad. This could mean at times he may be removing refractory that is satisfactory for welding and other times he may stop short and there could be a crack just a little deeper in the refractory so that the weld is adhered to a weak substrate, subsequently leading to premature failure of the repair. We at Fuse Tech feel chipping hammers, where the technicians can tell the status of the base refractory, is the preferred method of preparation.

THE BENEFITS

The key benefit to using ceramic welding is that it is performed while the furnace or vessel is at or near operating temperature. This eliminates the cost and the need to do a controlled cool down and/or heat up that is done during conventional repairs. This constitutes a major savings just in loss production time alone not counting the cost of replacing what was good refractory damaged during temperature cycling. During conventional repairs we often find ourselves having to remove good refractory in order to get at and remove the damaged area.

Another benefit for ceramic welding is that it is a dry repair as opposed to other methods which utilize water to one extent or another in order for the material to adhere to the wall. When water is used in a hot repair process it dramatically reduces the life of the repair. This results from thermal shock and steam generation that may cause the damaged area to become even larger. A steam layer can also adversely affect bonding to the hot substrate material.

THE COMPANY

Fuse Tech was founded in 1993, and in the following year received contracts from customers in the glass and coking industries. These jobs were completed in February 1995.

Our current employees now possess well over 100 years combined experience of ceramic welding. The ABILITY, ADAPTABILITY and EXPERIENCE of these employees have been major factors behind out past achievements and are guarantees for our future successes. Safety has a high priority within our organization and we continually train, our employees, and upgrade and monitor our safety programme.

Up until 2008 Fuse Tech was only active in the North American market. With Fuse Tech International we now offer our services worldwide.

We are proud to have served the following customers:

Customers	Location	Locations Welded
Glass Industry - USA		
AGC	Spring Hill, KS	Frontwall Crown Joint
Anchor Hocking	Lancaster, OH	Cold Face Weld Backwall Crown Joint
Cardinal Flat Glass	Portage, WI.	Port Sills, Port Face, Regenator Skew Line, Backwall & Frontwall Crown Joint
	Durant, Ok.	Skew Line, Port Arches Expansion Joint, Cold Face Weld
GE Lighting	Bridgeville, PA.	Backwall Crown Joint, Expansion Joint
Owens Corning	Waxahachie, TX.	Backwall Feeder Nose
Owens Illinois	Crenshaw, PA.	Port Cleaning
	Lapel, IN.	Port Cleaning, Checker Cleaning
Pilkington	Rossford, OH.	Skew Lines, Port Arches, Backwall Crown Joint
	Ottawa, IL.	Cold Face Weld All Port Crowns
	Laurinburg, NC.	Periscope Survey, Weld Backwall
	Lathrop, CA.	Port Arches, Port Walls, Cold Face Weld
PPG Industries	Mt. Zion, IL.	Port Arches, Frontwall Crown Joint, Backwall Crown Joint, Expansion Joints
Glass Industry - Mexico		
Fevisa	Mexicali	Center Crown
	San Louis Potosi	Regenator Division Wall, Periscope Survey
Vitro	Taluca	Breast Wall

FUSE TECH
INTERNATIONAL G.m.b.H.

Customers	Location	Locations Welded
Vitro Container	Monterrey	Periscope Survey
Glass Industry - Central America & Caribbean		
Carib Glass	Trinidad & Tabago	Periscope Survey
Vicesa Glass	San Jose, Costa Rica	Skew Lines, Breast Wall, Around Burner Blocks
Steel Industry		
Indiana Harbor Coke	East Chicago, IL.	Coke Oven Welding
Refiners Industry		
Exxon Mobile	New Orleans, LA.	Weld Around Burner Blocks
Glass Industry - Europe		
GE Lighting	Vac Hungary	Melting end crown
Saint-Gobain	Mannheim Germany	Doghouse arch Tuck stone above Burner Blocks
Steklarna	Hrastnik Slowenia	Regenerator crown Coldface Portneck joint
Lauscha Fiber	Lauscha Germany	Around Burner Blocks Entres Stack, Tuck Stones
Vidrala	Marina Grande Portugal	Crown Tuck Stone around Burner Blocks Regenerator Middle Wall
Wiegand Glas	Grossbreitenbach Germany	Coldface Skewback line Coldface Doghouse cover
Glass Industry - Middle East		
MGM	Cairo Egypt	Regenerator crown

For information,
please contact:

FUSE TECH
INTERNATIONAL G.m.b.H.

For US, Mexico, Canada:

Fuse Tech Inc.
546 Main Street
Cadiz OH 43907

UNITED STATES

Don Shamp
President

Phone: 0800 301 3873
Fax: 740 942 3565
E-mail: sales@fusetech.com
www.fusetech.com

For all other countries:

FUSE TECH INTERNATIONAL
GmbH
Stoltestr. 23
97816 Lohr am Main

GERMANY

Phone: +49 (0) 9352 508 100
Fax: +49 (0) 9352 508 120

www.fusetech.com
www.fuse-int.com

Member of the SKS Group

Holger Mayer
Managing Director

Phone: +49 (9352) 5081 23
Fax: +49 (9352) 5081 20
Mobile: +49 (170) 9950567
E-Mail: mayer@fuse-int.com