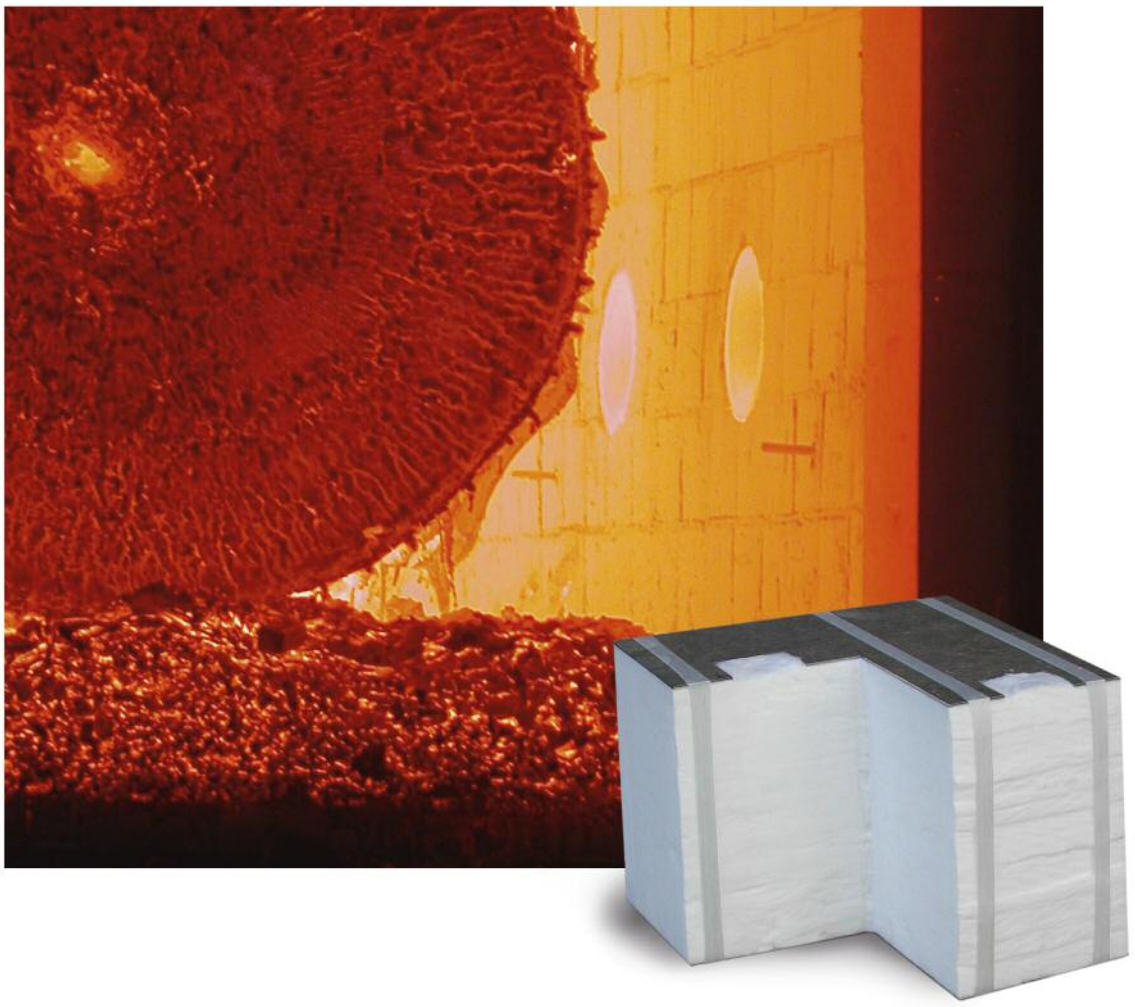
Tailor-made solutions for reheating furnaces in the steel industry.

Top quality refractory materials.



RATH

Specialist for top technology in high temperature.

Quality with an optimum price-performance ratio.

The Rath Group sales team

Rath offers the ideal combination of tradition and innovation. The result: optimum refractory solutions for a wide range of applications. All items in our broad product portfolio are manufactured in-house. With carefully selected materials and precision processing techniques, we can guarantee top quality.

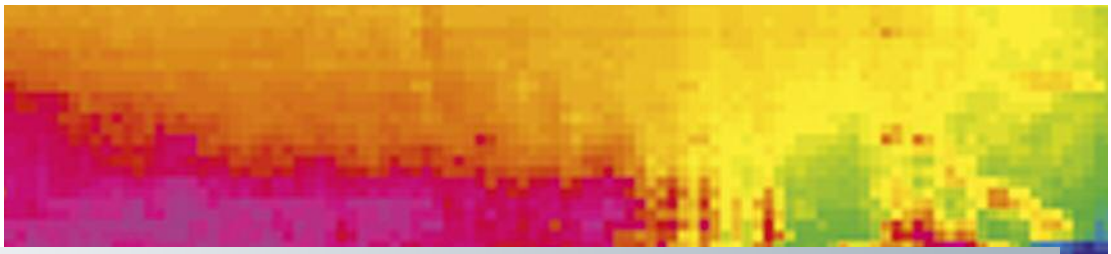
The Rath sales teams are focussed on the sector and familiar with its specific requirements; our technical offices provide the necessary engineering and assembly know-how. This means we can offer our customers individual, complete refractory solutions with an optimal price-performance ratio.

More efficient and cost-effective production.

Annealing forging in front of bogie hearth furnace

The Rath product range incorporates the latest technical developments. We are therefore able to offer you optimum refractory solutions. This is based on us offering our customers individual advice when selecting our products. Accordingly, we are able to contribute to improved productivity, higher purity steel, improved efficiency and cost savings. These are all critical factors, especially in the steel industry.

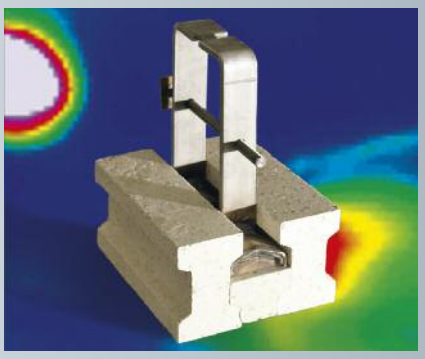
To meet these high demands we are continually setting ourselves new challenges. Our goal is to find innovative refractory solutions that meet your needs.



We live up to your high expectations.

Particularly in the steel industry there exists a demand for a high-performance continuous production process. Modern refractory materials and optimum calculated delivery concepts guarantee a smooth and profitable production. Add to that very high temperature demands, aggressive chemical reactions and especially unfavorable conditions.

In this field, Rath is a reliable partner that delivers heat insulating materials, refractory materials and special products for a wide variety of complex production plants.



Separation barrier bricks with anchorage

Our reputation is built on innovative thinking.

As a global player in the steel industry, Rath offers complete solutions and innovative delivery concepts. Our range includes high temperature insulating wool, vacuum-formed shapes, insulating fire bricks, precast blocks, dense refractory castables and dense refractory bricks.

They provide efficiency, security of operation and reliability for the following applications and units:

- Pusher-type furnaces
- Walking-beam furnaces
- Rotary hearth furnaces
- Rotary table furnaces
- Roller furnaces
- Soaking pit furnaces
- Chamber furnaces
- Bell-type furnaces
- Continuous pusher-type hardening furnaces
- Controlled-atmosphere hardening furnaces
- Bogie hearth furnaces
- Shaft furnaces
- Continuous galvanizing lines
- CSP lines

Think economically.
It's in your interests.

Shaft furnace with module lining

Roller insulation of a CSP line

Bogie hearth furnace with module lining

Where your requirements meet our expertise.

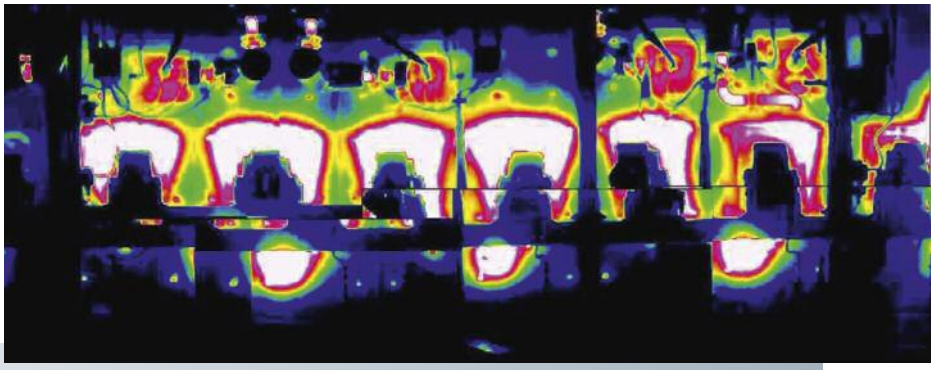
Your process technique requirements are our challenge. The right configuration of heat insulation is vital for the overall efficiency, high productivity and profitability of your production facilities. We combine a wide variety of materials within an overall concept that is oriented towards the future.

We analyze investment costs against operating costs using calculation models to find the right solution amongst a variety of different concepts.

Ultra light weight insulating

Name	**Calsitra Mat CMS 1100**
Raw material	Alkaline earth silicate wool
Classification temperature [°C]	1100
Bulk density [g/cm^3]	96-128
Chemical analysis [%]	
Al_2O_3	-
CaO/MgO	28

* this and all the following tables contain only



Thermal absorption of a conventional lining

Making the correct choice of materials.

Selection must take the full range of refractory demands into account:

- Operating temperature
- Furnace atmosphere (oxidizing or reducing)
- Operating mode (continuous or non-continous)
- Gas speed / Erosion
- Temperature shock
- Humidity / condensate vibration

Not forgetting the environment.

The right combination of materials has a direct effect on investment costs:

- Structural engineering configuration
- Refractory material
- Installation time of the furnace

and on operating costs:

- Energy costs
- CO_2/NO_x emissions
- Plant availability
- Flexibility and efficiency
- Maintenance costs

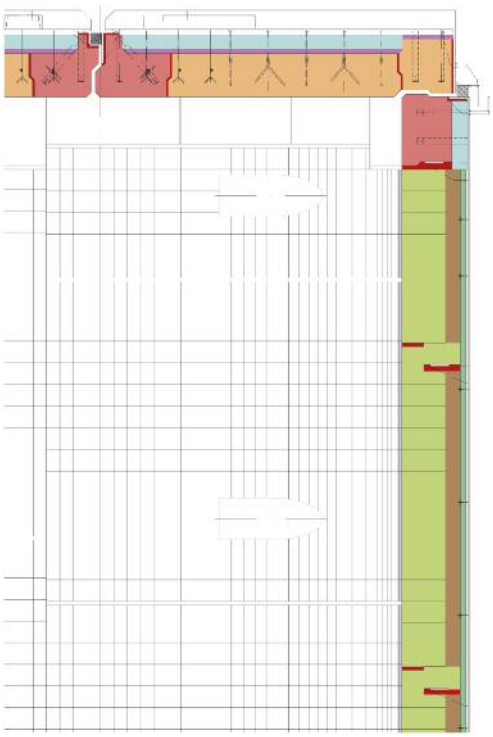
Thermal absorption of a lining improved by Rath

Materials *

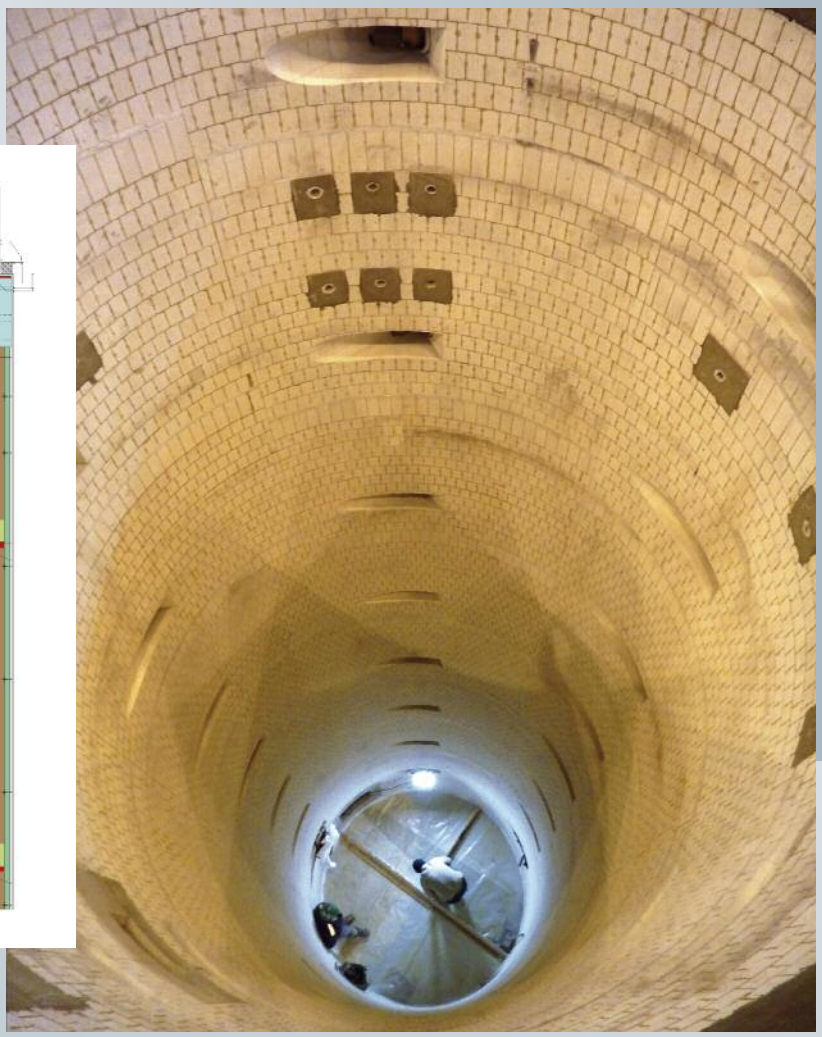
High temperature insulation wool (HTIW)					Vacuum-formed shapes		
Calsitra Mat MS 1250	**Alsitra Mat 1300**	**Alsitra Mat 1400**	**Altra Mat 72**	**Altra Mat 97**	**Evac EVS 121**	**Kerform KVS 121**	**Kerform KVS 141**
Alkaline earth silicate wool	Aluminium silicate wool	Aluminium silicate wool	Alumina wool	Alumina wool	Alkaline earth silicate wool	Aluminium silicate wool	Aluminium silicate wool
1250	1300	1400	1650	1500	1150	1250	1400
96-128	96-160	96-160	60-120	60-100	300	300	300
-	48	54	72	97	2	50	55
22	-	-	-	-	20	-	-

an extract of the wide Rath product range.

Always expect us to be one step ahead.



Construction section of auxiliary shaft furnace



Shaft furnace with insulating fire bricks

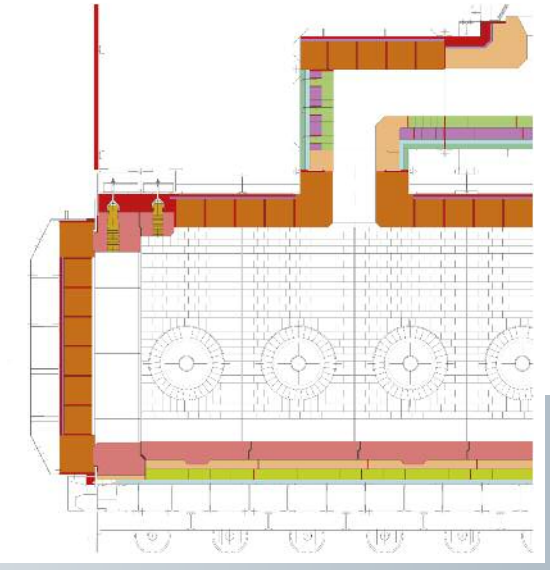
Roller furnace with new energetic optimized lining

Roller furnace after 5 years of operation

Variants of a wall lining.

As an example of the different possibilities for a wall lining, three variants of a bogie hearth forging furnace are given closer analysis at an application temperature of 1300°C.

By increasing the wall thickness, an insulating fire brick lining of the same value as the module lining can be achieved. A heavy lining with concrete or bricks causes a 40% higher wall loss when compared to the two lighter variants. The labyrinth and furnace car must be configured with dense materials on account of the mechanical stresses.



Construction section of Forging furnace

Forging furnace with insulating brick walls and module ceiling

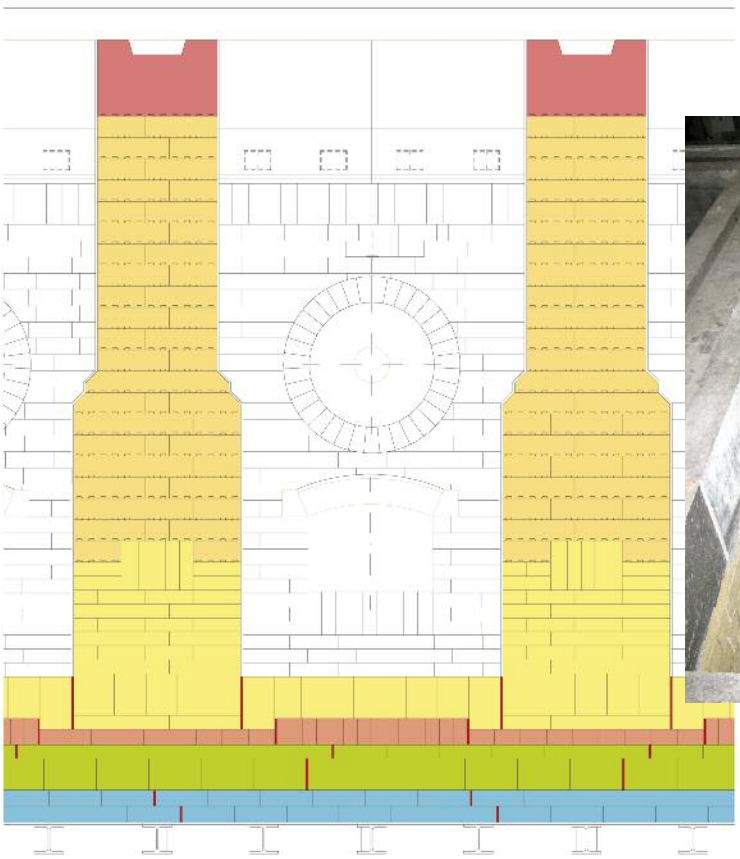
Type	Dense refractory lining		IFB lining		Module lining	
Wall thickness [mm]	230	Dense castable Carath LC 1655 or Silrath AK 60 brick	230	Insulating fire brick Porrath FL 28-09	300	HTIW-module Kombi Mod 72/1400
	125	Insulating fire brick Porrath FL 25-08	115	Insulating fire brick Porrath FL 24-06		
	50	Calcium silicate plate	50	Calcium silicate plate		
	50	Mineral wool plate	50	Mineral wool plate	25	Kerform KVS 121
					25	Alsitra Mat 1300
Total	**455**	**Wall thickness**	**445**	**Wall thickness**	**350**	**Wall thickness**

Weight	**700 kg/m²**	**293 kg/m²**	**62 kg/m²**
Heat loss	**917 W/m²**	**652 W/m²**	**679 W/m²**

Insulating fire bricks

Name	**Porrath® FL 24-06**	**Porrath® FL 25-08**	**Porrath® FL 25-10**	**Porrath® FL 26-08**	**Porrath® FL 28-09**	**Porrath® FL 30-11**	**Porrath® FL 34-15**
Raw material	Aluminium silicate	Aluminium silicate	Aluminium silicate	Aluminium silicate	Aluminium silicate	Aluminium silicate	Bubble alumina
Classification temperature [°C]	1350	1380	1400	1430	1540	1650	1840
Bulk density [g/cm³]	0,64	0,80	1,00	0,80	0,90	1,10	1,50
Cold crushing strength [MPa]	1,2	4	8	3,5	4	5	12
Chemical analysis [%]							
Al_2O_3	37	36	38	52	63	74	99
SiO_2	56	57	56	44	33	25	0,1

Taking an overall view guarantees perfection.



Soaking pit furnace

Construction section of auxiliary soaking pit furnaces

Rotary hearth furnace with dense lining

Rotary hearth furnace with module lining

Ceiling parts of pre-cast blocks

Variants of ceiling lining.

A suspended ceiling can be arranged in a variety of ways. Three variants are looked at in overview below.

The ceiling thickness for the dense configuration and the insulating lining cannot be made any thicker due to the weight. The module lining reduces heat loss across the ceiling compared to conventional linings by over 55%.

Optimized solution over the service life.

Not only the aforementioned heat loss, but also the operating mode of the furnace (in this case cyclic), different combustion temperatures and investment costs influence the overall profitability of a plant.

Accordingly, higher investment costs can be written off within 2 to 3 years through lower operating costs of up to 65%. It pays dividends to consider the furnace as a whole.

Type	Dense refractory lining		IFB lining		Module lining	
Ceiling thickness [mm]	180	Dense castable Carath LC 1655	230	Insulating fire brick Porrath FL 30-11	300	HTIW-module Kombi Mod 72/1400
	50	Alsitra Mat 1400				
	70	Carath FL 1052	70	Carath FL 1052	25	Kerform KVS 121
					25	Alsitra Mat 1300
Total	**300**	**Ceiling thickness**	**300**	**Ceiling thickness**	**350**	**Ceiling thickness**

Weight	**567 kg/m²**	**285 kg/m²**	**62 kg/m²**
Heat loss	**1600 W/m²**	**1314 W/m²**	**679 W/m²**

Dense Bricks

Name	Suprath A 40-t	Durrath HS-e	Silrath AK 60	Silrath AK 60 SiC	Alurath B 80	Korrath® K 65	Korrath® K 99
Raw material	Fireclay	Low iron Fireclay	Andalusite	Andalusite/ Silicon carbide	Bauxite	Mullite contained Fireclay / Corundum	Corundum
Bulk density [g/cm³]	2,28	2,35	2,60	2,60	2,75	2,55	3,40
Cold crushing strength [MPa]	50	80	100	100	100	80	80
Porosity [Vol.-%]	14	16	13	11	18	17	13
Thermal shock resistance [n]	18	30	120	120	100	15	8
Chemical analysis [%]							
Al_2O_3	40	47	60	45	80	64	99
SiC	-	-	-	15	-	-	-

We are there to the end.

Assembly of an insulating fire brick lining

Module assembly

Pre-assembly of a continuous pusher-type hardening furnace

Walking-beam furnace with pre-cast shapes

Castable lining in roller furnace

Carath® – unshaped refractories

Name	Insulating castables			Dense castables			
	Carath® FL 1052	**Carath® FL 1250**	**Carath® FL 1401**	**Carathgun D 1501**	**Carath® LC 1300**	**Carath® LC 1550**	**Carath® LC 1652**
Raw material	Perlite	Light weight fireclay	Light weight fireclay	Andalusite	Fireclay	High mullite fireclay / Bauxite	Bauxite
Application temperature [°C]	1052	1250	1400	1500	1300	1550	1650
Bulk density [kg/m³]	650	1620	1400	2260	2280	2400	2850
Cold crushing strength [MPa]	1,2	20	25	35	80	100	85
Chemical analysis [%] Al_2O_3	40	40	45	60	42	60	85

Production in our own factories.

There is one very special feature of Rath: we can always fully guarantee the quality of our highly refractory products, as we manufacture them all ourselves.

State-of-the-art production processes are used in our plants in Europe and the USA. We constantly adapt these processes in line with technical and technological developments as we strive to provide you with top quality.

Our approach benefits our customers: high quality products ensure operational safety and reliability over a long period of time. This means less repairs, less breaks in production and lower costs.

Krummnußbaum

Bennewitz

Mönchengladbach

Our service, for the long run.

Our engineering departments develop the best solutions and employ technicians who are responsible for the correct implementation of our ideas at the customer's premises. For even the most demanding of requirements, we are there, on-site. Qualified supervisors and experienced technicians implement our expertise at the construction site. At least one of our employees is always present during assembly. This is another reason why we can guarantee the durability of our refractory linings.

	Carath® LC 1655
	Andalusite
	1650
	2550
	75
	63

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