



## >> Solutions for Wear Protection in Iron and Steel Industry



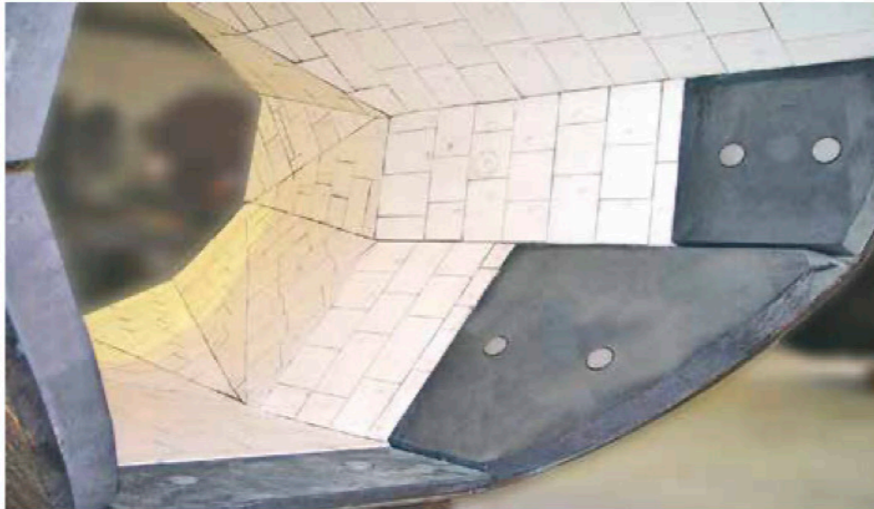
## >> Work with Kalenborn for Your Optimal Solution

### Reduce Costs and Avoid Downtimes

Large quantities of bulk material are handled in the conveying and storing systems of the iron and steel industry.

Kalenborn offers a complete array of wear protection materials, including not only ceramic and metallic materials, but also plastics and rubber.

In addition, Kalenborn has extensive experience in slide promotion. Interruptions of material flow inside of bunkers and silos must be avoided.



Octagonal hopper with three-dimensionally cut shaped elements made of KALOCER high-alumina ceramics and KALCAST hard casting, each 50 mm thick

#### Advantages of Lining Materials:

##### Ceramic Wear Protection

- Very good abrasion resistance
- Tile, cylindrical or jointless lining
- Temperatures up to 1,250 °C/2,282 °F

##### Metallic Wear Protection

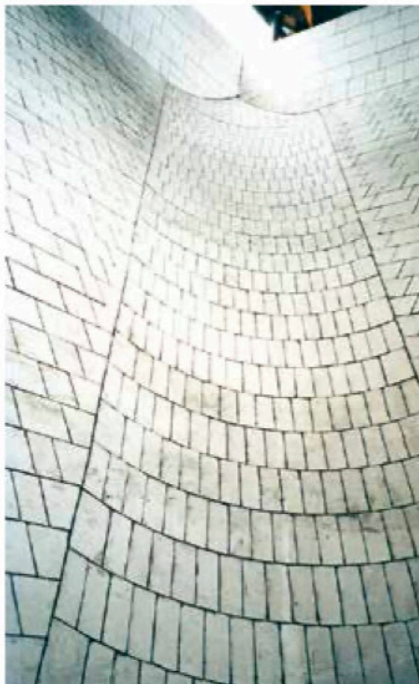
- Good resistance against sliding and impact wear
- Thin walls, self-supporting structures
- Good thermal shock resistance

##### Technical Plastic Lining

- Excellent slide promotion for many application
- Good resistance against impact wear
- Low weight

##### Material Combinations

- Optimal wear protection for every application
- Optimized lining cost
- Optimized weight



Bunkers for blast furnace charging are effectively lined with KALOCER



Tailor-made cast shaped elements of KALCOR zirconium corundum warrant reliable wear protection in the cone of a dust collector, even at high temperature and heavy thermal cycles.

## >> Pipes, Components and Service

### Optimal Solution for every Plant Component



On average, 60 tonnes of coal with grain sizes from 0.5 to 13 mm pass through the dense media cyclone in an hour. This equates to a speed of 3 m per second. Due to the high throughput of material and the density of material impacting on the cyclone walls, there is a high degree of wear on them. In conjunction with optimized overall design the cyclone consists of lining with KALCOR S cones with inside radius of 600 mm.



#### Wear protection in the iron and steel industry increases the lifetime of plant components

Plant components are at risk in all sections of the iron and steel industry, especially in raw material storage and processing, sintering and coking plant, blast-furnace operation and slag handling. Comprehensive wear protection is an absolute must for steel production systems and rolling mills as well.



Extended service life of plant components



Hydraulic and pneumatic pipes

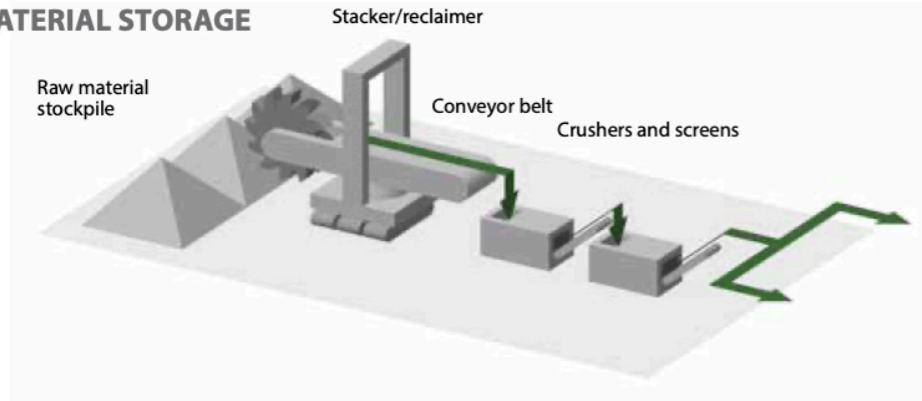


Kalenborn service solves wear problems on site

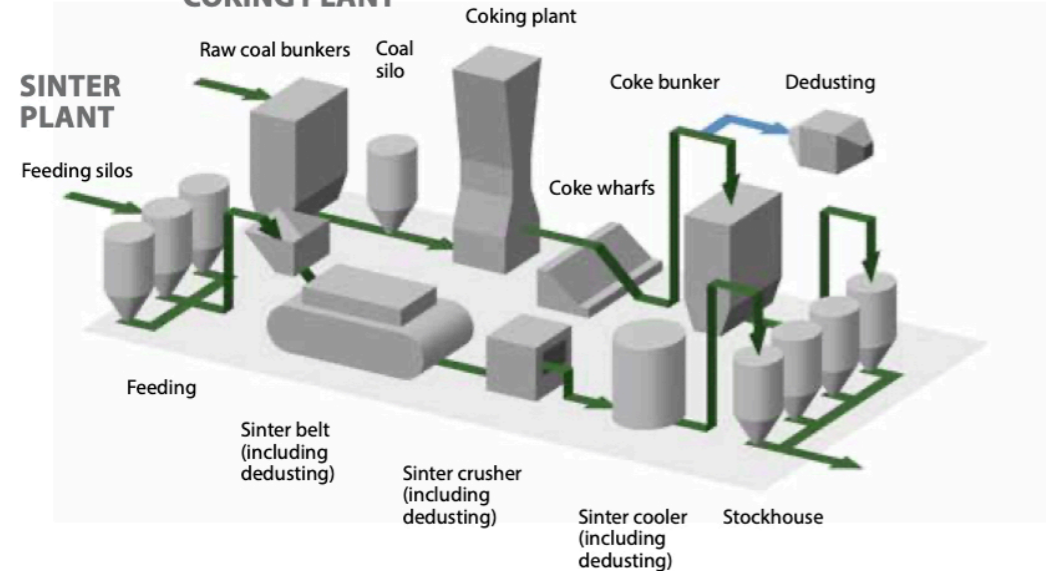
- ABRESIST fused cast basalt
- KALCOR zirconium corundum
- KALCOR S sintered zirconium corundum
- KALOCER high-alumina ceramics
- KALCERAM wear-resistant hard ceramic
- KALCRET hard compound
- KALSICA silicon carbide ceramics
- KALCAST hard casting
- KALMETALL hard overlay welding
- KALEN slide promotion plastics

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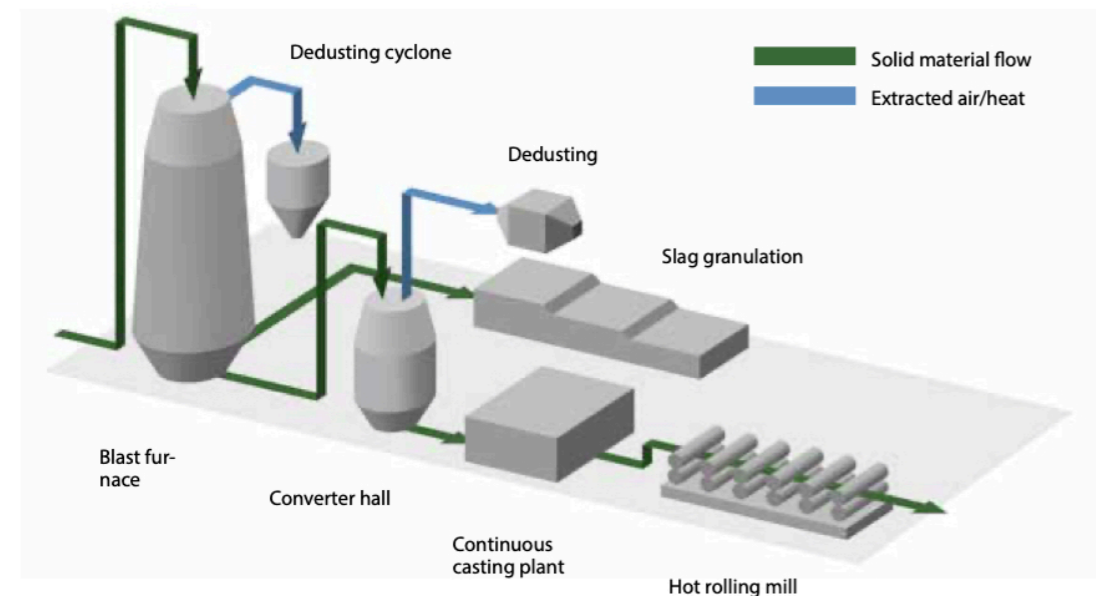
## RAW MATERIAL STORAGE



## COKING PLANT



## PIG IRON AND STEEL PRODUCTION



## STORAGE

Plant	Components	Material for lining
Stacker/reclaimer	Bucket wheel, transfer chutes, bunkers	KALCAST, KALMETALL, KALOCER, ABRESIST, KALEN
Crushers/screens	Housing, slides, transfer chutes	KALCAST, KALMETALL, KALOCER, KALEN

## COKING PLANT

Plant	Components	Material for lining
Raw coal bunkers	Transfer chutes, crushers, screens	KALEN, ABRESIST, KALCAST, KALMETALL, KALOCER
Coal silo	Transfer chutes	KALEN, ABRESIST, KALMETALL, KALOCER
Quenching tower	Quenching cars	KALCRET, KALCOR, KALMETALL
Coke wharfs	Discharge and extraction equipment	KALCERAM, KALCOR, KALSICA, KALCAST, KALMETALL, KALCRET
Coke bunker	Transfer chutes, crushers, screens	ABRESIST, KALMETALL, KALOCER, KALCOR
Dedusting	Hoods, ducts, pipelines	KALCRET, ABRESIST, KALOCER

## SINTER PLANT

Plant	Components	Material for lining
Feeding silos	Discharge and extraction equipment, slides	ABRESIST, KALOCER, KALCOR, KALMETALL
Sinter belt	Feeding drum, wind boxes	KALOCER, KALMETALL, KALCRET, KALCOR
Sinter crusher	Crash deck, sinter crusher, pallet bars, chutes, screens	KALCAST, KALMETALL, KALCOR, KALCRET
Sinter cooler	Housing, chutes, screens	KALMETALL, KALCOR, KALOCER, KALCRET

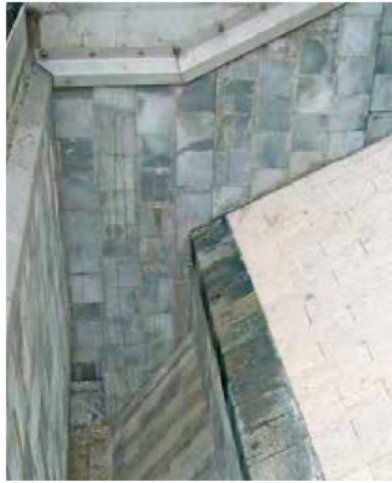
## PRODUCTION

Plant	Components	Material for lining
Stockhouse	Bunkers, discharge and extraction equipment, slides	ABRESIST, KALCRET, KALOCER, KALMETALL
Dedusting	Hoods, ducts, pipelines	KALCRET, ABRESIST, KALOCER, KALMETALL
Blast furnace	Skips, bell less top (BLT), pulverised coal injection	KALOCER, KALCAST, KALMETALL, ABRESIST
Dust catcher/cyclone	Ducts, pipelines, discharge equipment	KALCRET, KALCOR, ABRESIST, KALMETALL
Slag granulation	Condensing tower, tanks, flumes, slag sand pipelines and silos	KALCRET, KALCOR, ABRESIST, KALOCER, KALMETALL
Converter hall	Alloying material plant, pulverised coal and limestone injection, dedusting	KALMETALL, KALOCER, ABRESIST, KALCRET
Continuous casting plant	Scale flumes and scale water pipelines	ABRESIST, KALCRET
Hot rolling mill	Descalers, scale flumes and scale water pipelines	KALMETALL, KALOCER, ABRESIST

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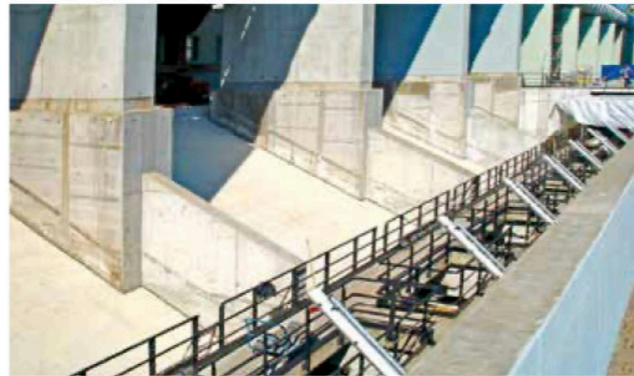
## Reliable Operation in Coking Plants

Coke loading bay: the impact edge is protected by KALCAST C153 hard casting, the sliding surface with KALCERAM K hard ceramics and the temperature stressed sides with KALSICA P silicon carbide ceramics

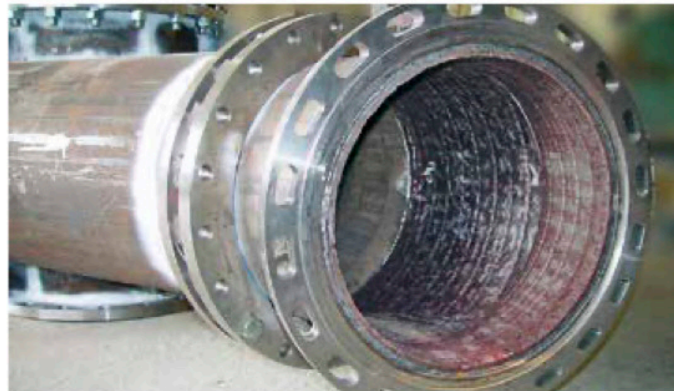


A trouble-free material flow is ensured in coal bunkers by the use of KALEN slide promotion plastics

Discharge edge of a coke loading bay the KALCAST hard cast components are fixed mechanically



Kalenborn also successfully use KALCOR zirconium corundum and KALCRET hard compound in the area of coke loading bays



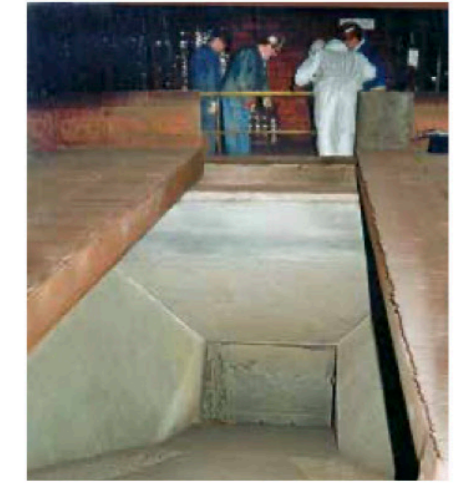
Pipe made of KALMETALL W100 hard overlay welding, inner diameter 500 mm



Proven wear protection material for bunkers in the coke handling is ABRESIST fused cast basalt

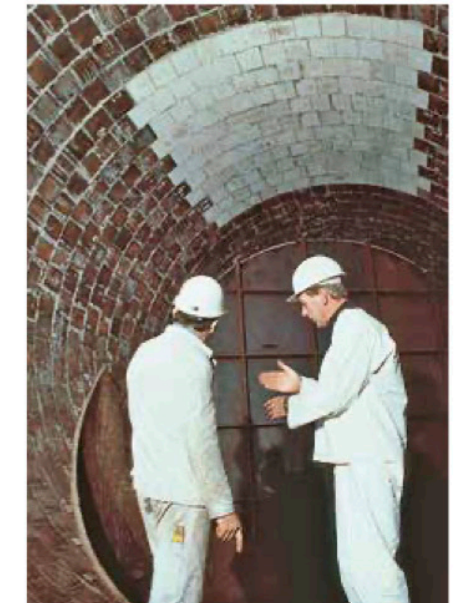
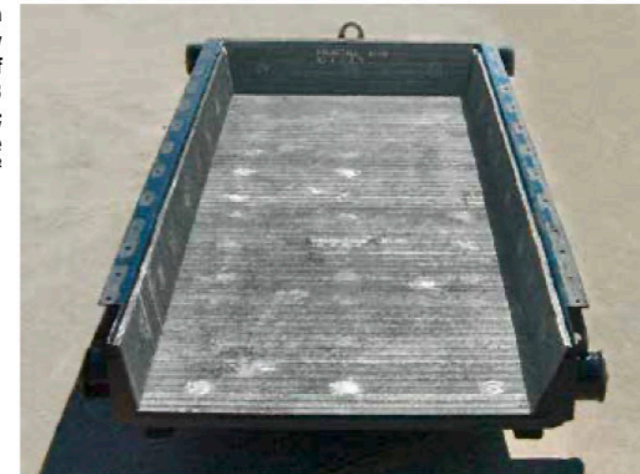
## Long Duty Cycles in Sintering Plants

Collecting hopper being part of sintered material dust collection at 400° C/752 °F: effectively protected with KALCOR zirconium corundum



Quick installation of abrasion resistant lining for wind boxes, i.e. sprayed-on KALCRET BNS hard compound

Lining of a vibratory chute made of KALMETALL W143 hard overlay welding; the lined surface covers 10 m<sup>2</sup>



KALCOR zirconium corundum fitted to the deflection zone where abrasive sintered particles impinge at temperatures of 250°C/482 °F and high velocity, an economic solution when combined with ABRESIST fused cast basalt

Screens for hot sintered material made of KALMETALL W145; the screen surface is of herringbone pattern



# >> Wear Protection in Iron and Steel Industry

## Trouble-free Operation of the Blast Furnace



Pressure compensating pipe at the blast furnace; self-supporting structure of KALMETALL W100 30 + 6 hard overlay welding; 450 mm Ø



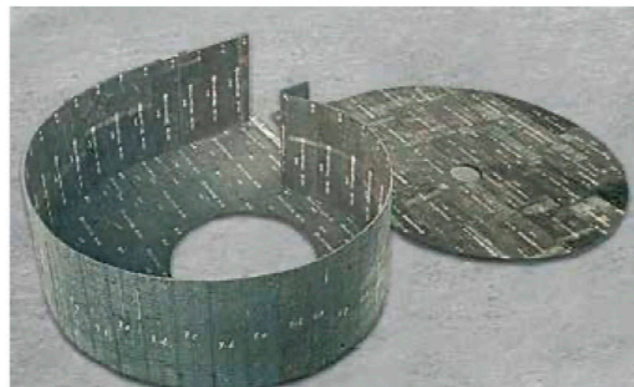
Feeding hopper integrated in the blast furnace with mechanically fixed KALOCER tiles



Distributor tilting chute being part of blast furnace lining fitted with KALOCER high-alumina ceramics, 50 mm thick



Octagonal hopper with KALOCER lining; for optimal adaptation the 50 mm thick shaped elements have been cut three-dimensionally



Wear protected fan housing of KALMETALL hard overlay welding, 2,000 mm Ø

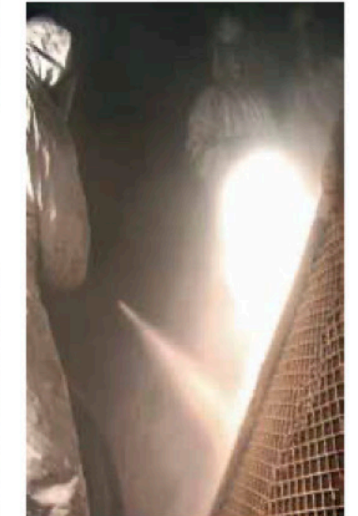
## From Feeding to Dust Collection



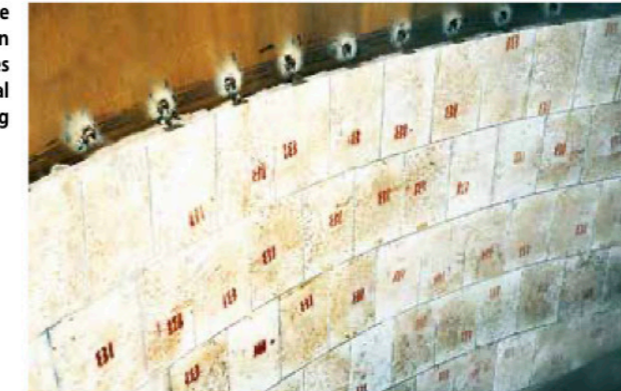
Cyclone separator cones of KALMETALL W100 6 + 4 fixed by means of bolt welding



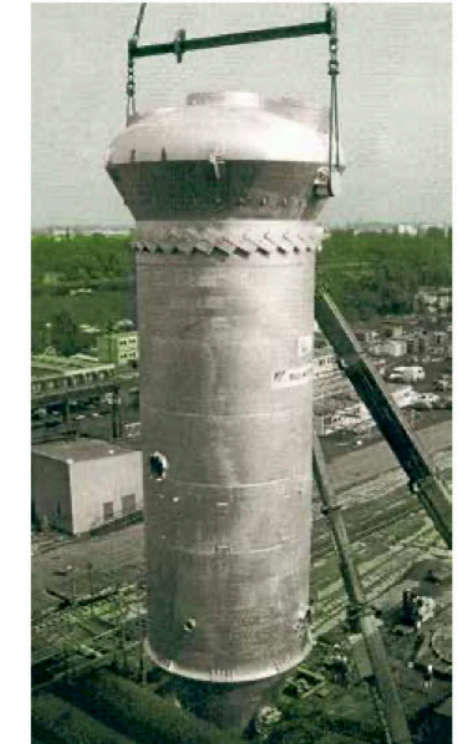
Short lining times for a whirler are achieved with a combined lining of hard compound KALCRET BTS and zirconium corundum KALCOR. The high application rate of KALCRET BTS is 5 m<sup>2</sup>/h



KALCOR is a suitable lining material even at high temperatures and high thermal cycling



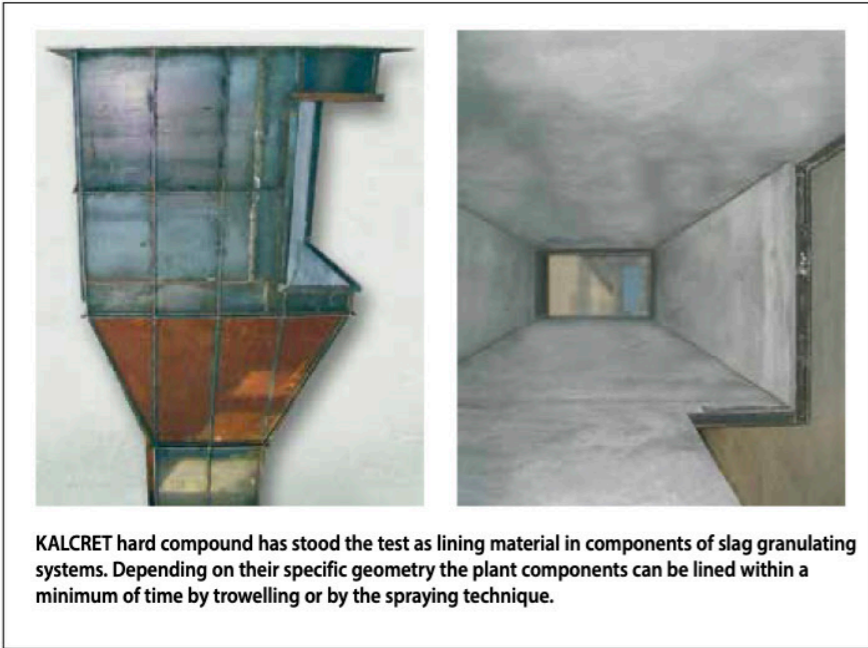
Depending on the specific plant design dust collection cyclones are protected either with ABRESIST fused cast basalt, KALCOR zirconium corundum, KALCRET hard compound or KALMETALL hard overlay welding



Dust collection cyclones for blast furnaces are effectively protected with combined linings

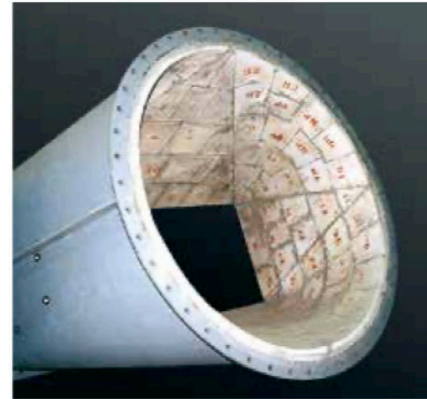
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## Slag Handling and Other Applications

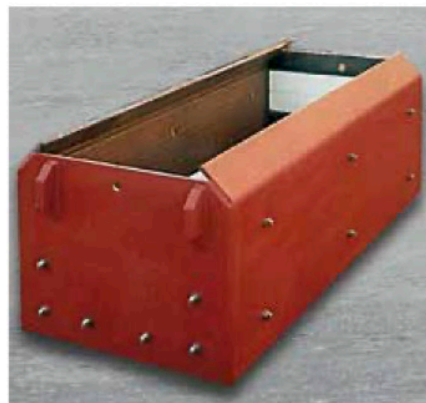


KALCRET hard compound has stood the test as lining material in components of slag granulating systems. Depending on their specific geometry the plant components can be lined within a minimum of time by trowelling or by the spraying technique.

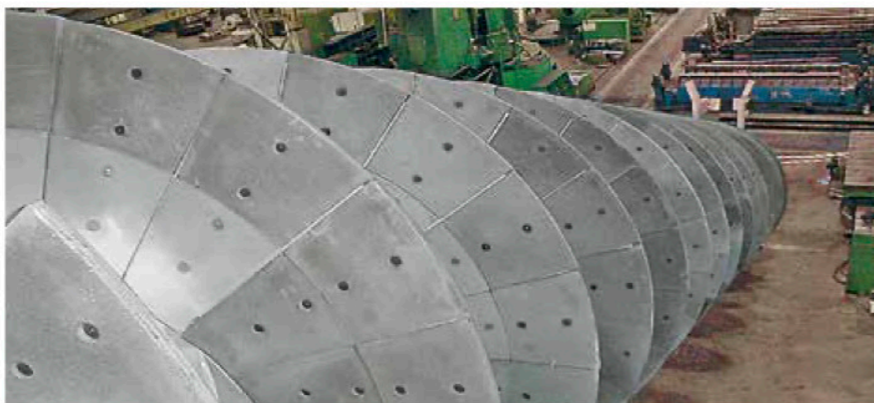
Time-proven in troughs of slag granulation: KALCRET hard compound



KALCOR zirconium corundum is the ideal wear protection material in case of high stress caused by wear, temperatures and temperature changes; not only lining of plant components but also of pipes is feasible

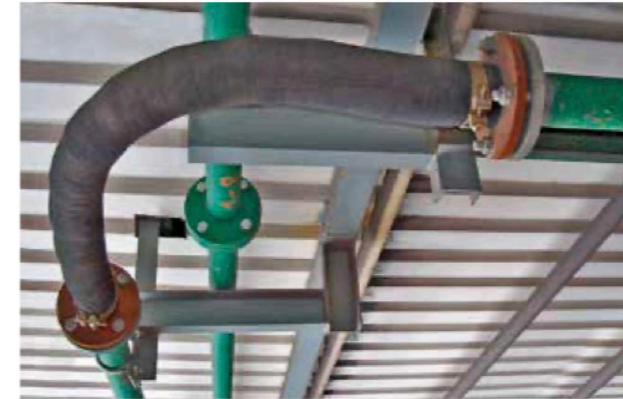


Brake box of a slag granulating system; in the zone of maximum wear the structure of KALMETALL has been lined with KALOCER tiles

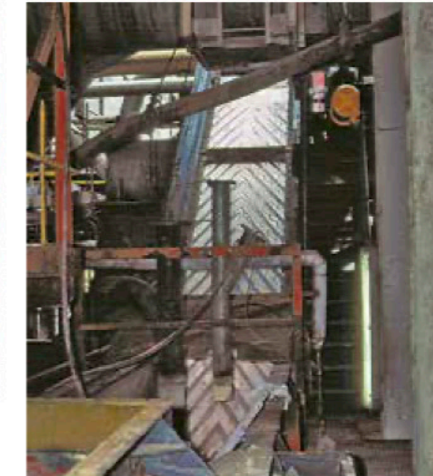


Conveyor screw being part of a slag granulating system; screw flights lined with KALMETALL C155; the screw has a diameter of 1,200 mm

## Long Duty Cycles of Plant Components



KALFLEX pipe bends in practical operation; here shown as flexible connection between rigid connection points



Chain conveyors are effectively protected with ABRESIST, KALOCER, KALMETALL or KALCRET



Down pipes of a direct reduction line made of KALMETALL W151, 355 mm diameter; basic material 1.4829 of 12.8 mm



KERAFLEX is a composite material that combines the hardness of KALOCER oxide ceramics with impact resistant rubber



Scale launders are effectively lined with ABRESIST fused cast basalt



Prefabricated KALCRET guide vane for an agitator

## Wear Resistant Linings

Lining	Material Hardness		Process Parameters			Resistance		
	Mohs	Vickers HV 1	Max. conveying speed m/sec.	Max. temperature		Wear resistance	Thermal shock resistance	Impact resistance
				°C	°F			
ABRESIST fused cast basalt	8	770	20	350	662	+++	+	+
KALOCER high alumina ceramics	9	1,050	30	1,000	1,832	++++	+	+
KALCOR zirconium corundum	9	900	30	1,000	1,832	++++	++	++
KALCOR S sintered zirconium corundum	9	970	25	1,200	2,192	+++	+++	++
KALSICA N silicon carbide ceramics	9	1,100	25	1,550	2,822	+++	++++	+
KALSICA S silicon carbide ceramics	9	1,600	35	1,250	2,282	++++	++++	++
KALCERAM wear-resistant hard ceramic	7	500	20	350	662	++	+	+
KALCRET hard compound	8	1,250 *	20	1,200	2,192	++++	++	++
KALMETALL W100 hard overlay welding	7	700	20	350	662	++++	+++	+++
KALCAST C155 hard casting	7	700	20	350	662	++++	+++	++

\* referred to the hard aggregate material

## Slide Promotion Linings

Lining	Slide Promotion	Max. Temperature °C / °F		Wear Resistance
KALEN slide promotion plastics	+++++	80	176	+
KALCERAM wear-resistant hard ceramic	+++	350	662	++
ABRESIST fused cast basalt	+++	350	662	+++

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