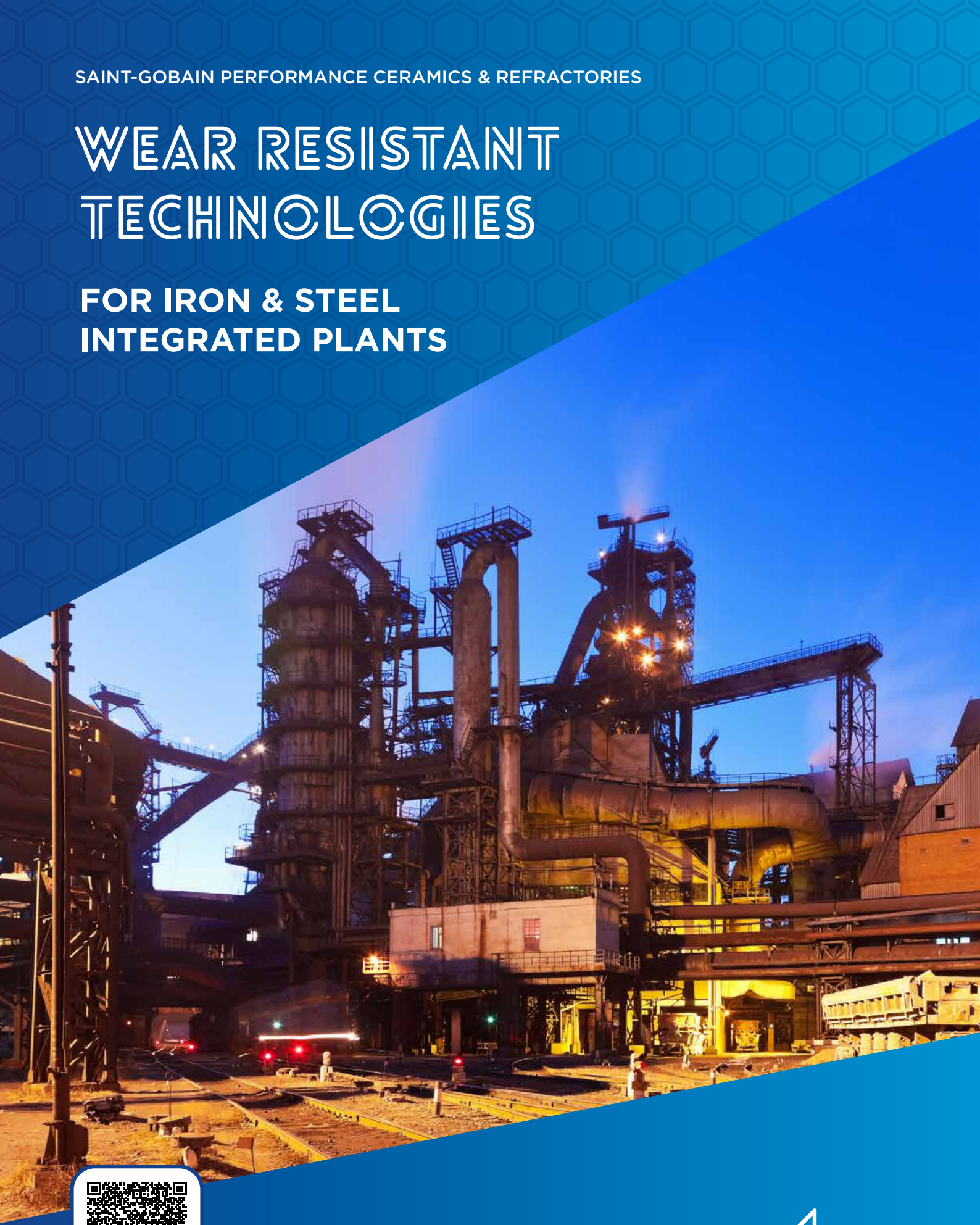
SAINT-GOBAIN PERFORMANCE CERAMICS & REFRACTORIES

WEAR RESISTANT TECHNOLOGIES

FOR IRON & STEEL INTEGRATED PLANTS



SAINT-GOBAIN

SAINT-GOBAIN

2024

Derwent Top 100 Global Innovator 2024

Clarivate Analytics

top EMPLOYER Global 2025

FOR A BETTER WORLD OF WORK

46.6
in euro billion
2024 sales

161,000
employees

Represented in
80
countries

WE ARE COMMITTED TO ACHIEVING NET ZERO CARBON EMISSIONS BY 2050

1,100
manufacturing facilities

-34 %
Scope 1 & 2 CO_2 Emissions
(2024 vs. 2027)

8
main
R&D centers

PIONEERING CERAMICS FOR A BETTER TOMORROW

SAINT-GOBAIN PERFORMANCE CERAMICS & REFRACTORIES

WEAR RESISTANT TECHNOLOGIES

Saint-Gobain's strength in wear resistance is in custom engineering shapes in their pre-fired state. Our objective is to improve the performance, efficiency, and equipment life of our customers' material-handling equipment. We provide cost-effective solutions for solving wear and corrosion problems encountered in heavy industry during daily routine plant operations. Extending the life of your material-handling equipment and keeping your systems at maximum operational levels is a top priority.

KEY MARKETS

- Iron Making
- Powder & Bulk Solids
- Aggregates
- Mining & Mineral Processing
- Grain Handling
- Asphalt
- Chemical Processing
- Cement
- Pulp & Paper
- Coal Fired Power
- Recycling
- Environment

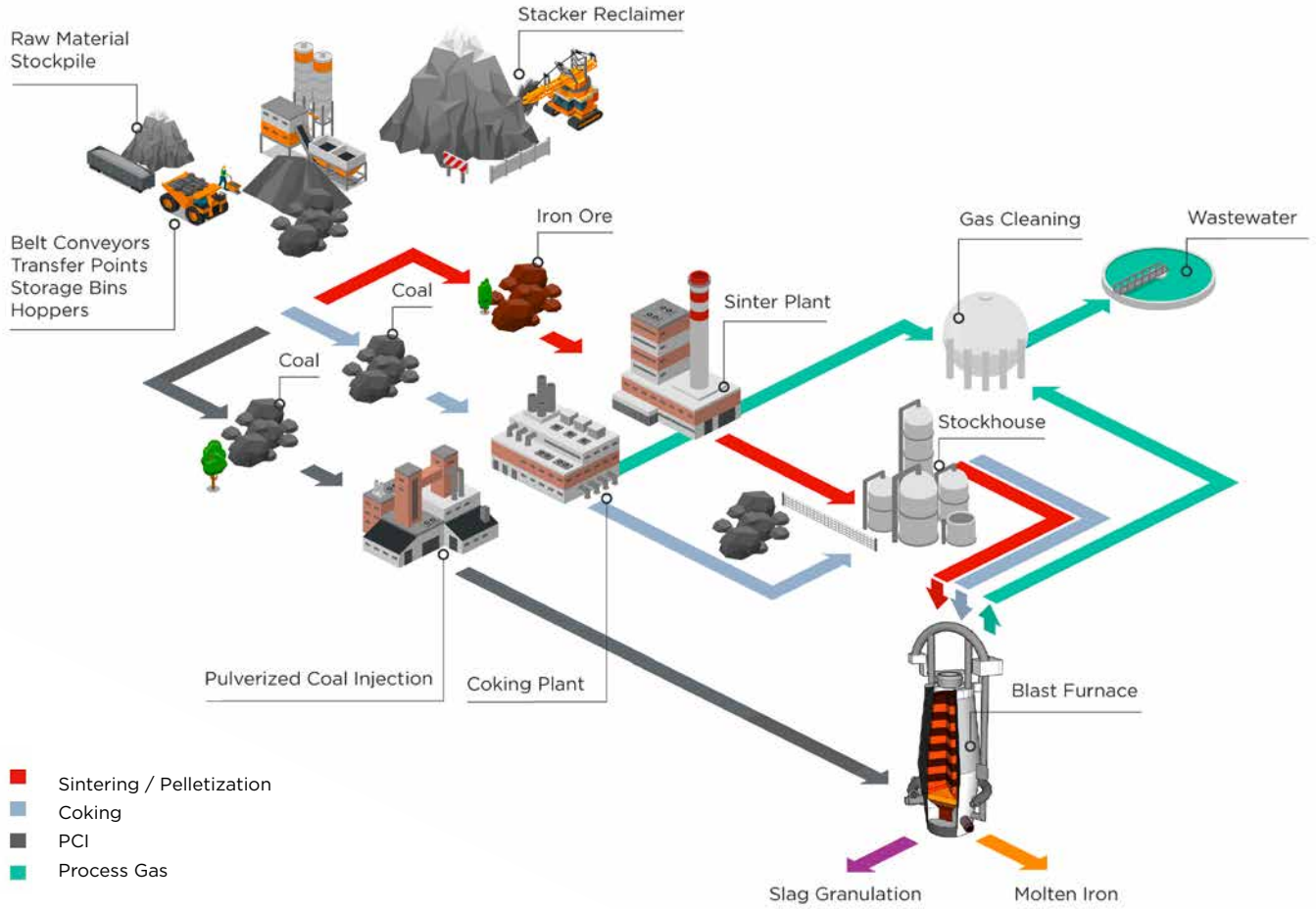
OUR MATERIALS DELIVER VALUE

- Alumina (90 & 92%)
- Zirconia Toughened Alumina
- Nitride Bonded Silicon Carbide
- Reaction Bonded Silicon Carbide
- Sintered Silicon Carbide
- Alumina - Zirconia - Silica
- Monolithics

WEAR RESISTANT TECHNOLOGIES SOLUTIONS

When it comes to the highest quality for the toughest demands, our Wear Resistant Technologies Business Unit sets new standards. Our unique products and solutions, which are specially developed with a focus on serving applications across various markets designed to resist various types of wear and help you achieve a consistent performance as a result. Take advantage of our experience in wear-resistant ceramics and benefit from our wide product range, which offers a solution for all plant components.

Reduce Costs **Avoid Shutdowns**



IRON MAKING

- Stockhouse
- Blast Furnace Top Components
- Gas Cleaning
- Wastewater
- Dock & Yards
- Slag Granulation
- Pulverized Coal Injection (PCI)

COKING PLANT

- Coal Handling
- Wharf & Wharf Belts
- Coke Side Emissions
- Screening Station

SINTER PLANT

- Raw Material Preparation
- Mix & Re-roll Drum
- Sinter Machine
- Crash Deck
- Hot Screens
- Cooler
- Scrubber / Fume Emission System
- Stock Pile / Stockhouse Feed Belt

RAW MATERIAL HANDLING

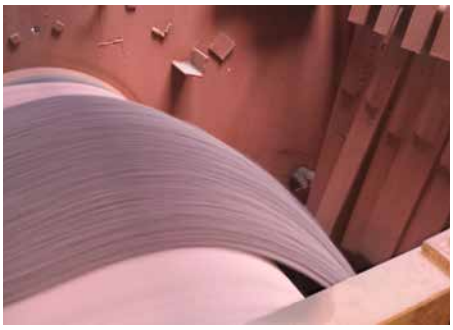
The conveyance and transfer of materials is a challenging and demanding process due to abrasion / impact from the abrasive materials and / or the volume of material that are transferred onto conveyor belts. Ceramic materials with high wear and impact resistance are preferred over traditional materials like abrasion resistant steels, weld overlay, plastics, (ceramics embedded in) urethanes and rubber to reduce overall downtime due to maintenance and frequent change overs.

OUR MATERIALS HOLD UP

Our solutions have been assisting customers in extending the life of dynamic and static equipment with one of our many ceramic material solutions. With over 50 years of continual practical ceramic application experience with wear resistance materials, our products are the most cost-effective for your application. View a sample of our successful applications below.

Coal or Ore Yard Stacker / Reclaimer

Ore Bridge & Conveyor Chutes

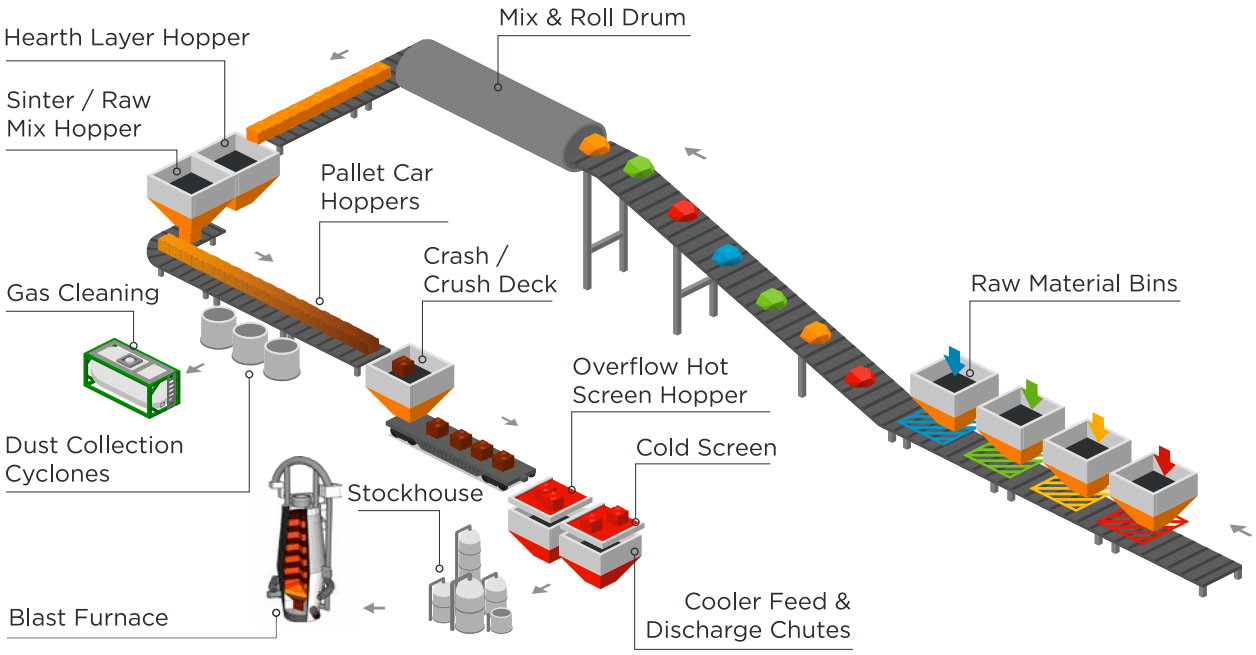


Conveyor Head Chute

COMPONENTS	APPLICATIONS	MATERIALS
Stacker / Reclaimer	Head Chute Loading Gantry / Center / Spoon Chute / Skirt / Bang Boards Reclaim Buckets	Durafrax® Durastrike® ZTA ZAC - Corguard (AZS) WearPak® / WearFix®
Belt Conveyors	Head Chutes Transfer Points Storage Hoppers Skirt / Bang Boards	Durafrax® Durastrike® ZTA ZAC - Corguard (AZS) WearPak® / WearFix®
Underground / Storage Hopper	Cones / Storage Hoppers Weigh Feeders Head Chutes / Transfer Points Skirt / Bang Boards	Durafrax® Durastrike® ZTA ZAC - Corguard (AZS) WearPak® / WearFix®

SINTER / PELLETIZATION SOLUTIONS

We provide a wide range of ceramic materials and solutions for the sintering / pelletization processes. Our innovative wear products can be found in every section of the sintering process of iron ore fines. They range from the preparation of a sinter mixture to the recycling of the fines from the sinter plant and blast furnace.



Conveyor Transfer

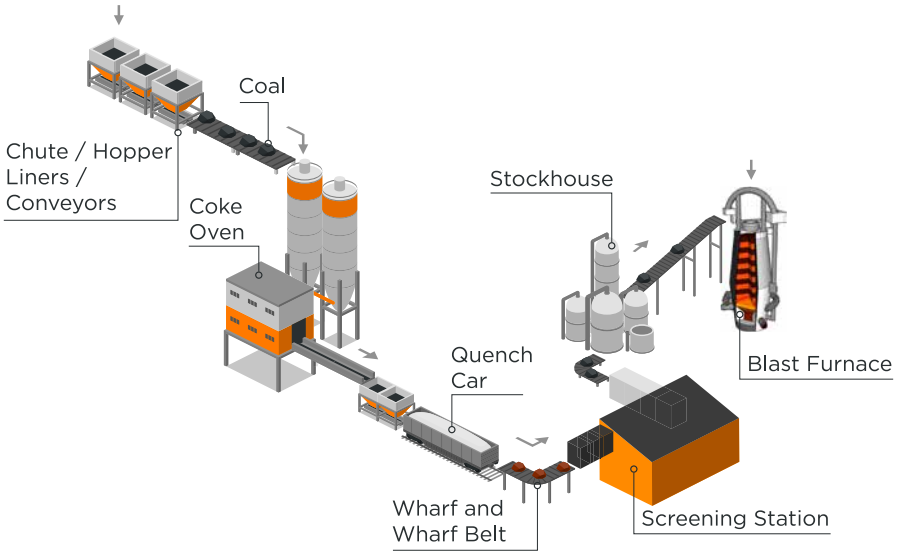
Hearth Layer / Sinter Mix Feed Chute

Raw Material Bin

COMPONENTS	APPLICATIONS	MATERIALS
Raw Material Preparation Mix & Re-roll Drum	Re-claimer Chutes Hopper / Bins Liners Skirt Boards Transfer Points Drum Lining	Durafrax® Durastrike® ZTA
Sinter Machine Crash Deck	Hearth Layer Sinter Hopper Sinter Machine Hoppers Ductwork Linings	Durafrax® Durastrike® ZTA ZAC - Corguard® Wearfrax®
Hot Screens Cooler Cold Screens	Crash / Crush Deck Lining Hot Screen Feed Chute Cooler Feed & Discharge chute	Durastrike® ZTA ZAC - Corguard®
Scrubber / Fume Emission System Stock Pile / Stockhouse Feed Belt	Flooded Elbow Venturi Vanes / Valves Level Control Piping Cyclones	Durafrax® Durastrike® ZTA Wearpak®

COKE PLANT SOLUTIONS

When it comes to coke plant technologies, we are your supplier for excessive wear applications which require special materials and solutions. Our portfolio is designed for use under the most severe conditions and can be found throughout the entire coke manufacturing process.



COMPONENTS	APPLICATIONS	MATERIALS
Screening Station	Chute / Hopper Liners Transfer Points Screen Feed Boxes	Durafrax® ZAC - Corguard (AZS)
Wharf & Wharf Belts	Hot Car Discharge & Coke Nose Wharf Skirts Board Liners Coke Plow Parts	Durafrax® ZAC - Corguard (AZS)
Coke Side Emissions	Lined Ductwork / Piping Spray Headers Venturi Liners	Durafrax® Cryston® / Refrax®

Coal Silo Feed System – Durafrax®

Coke Wharf & Belt

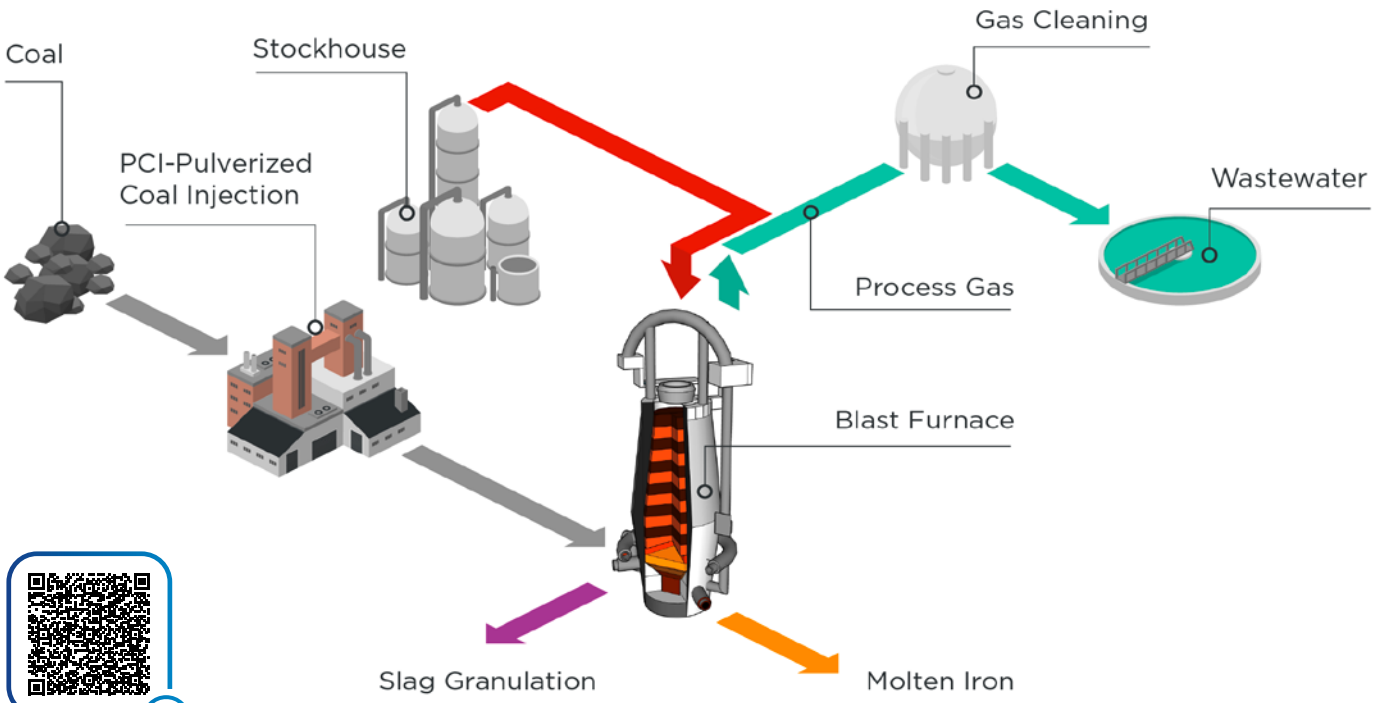
Coke Plow Car Durafrax® Panels

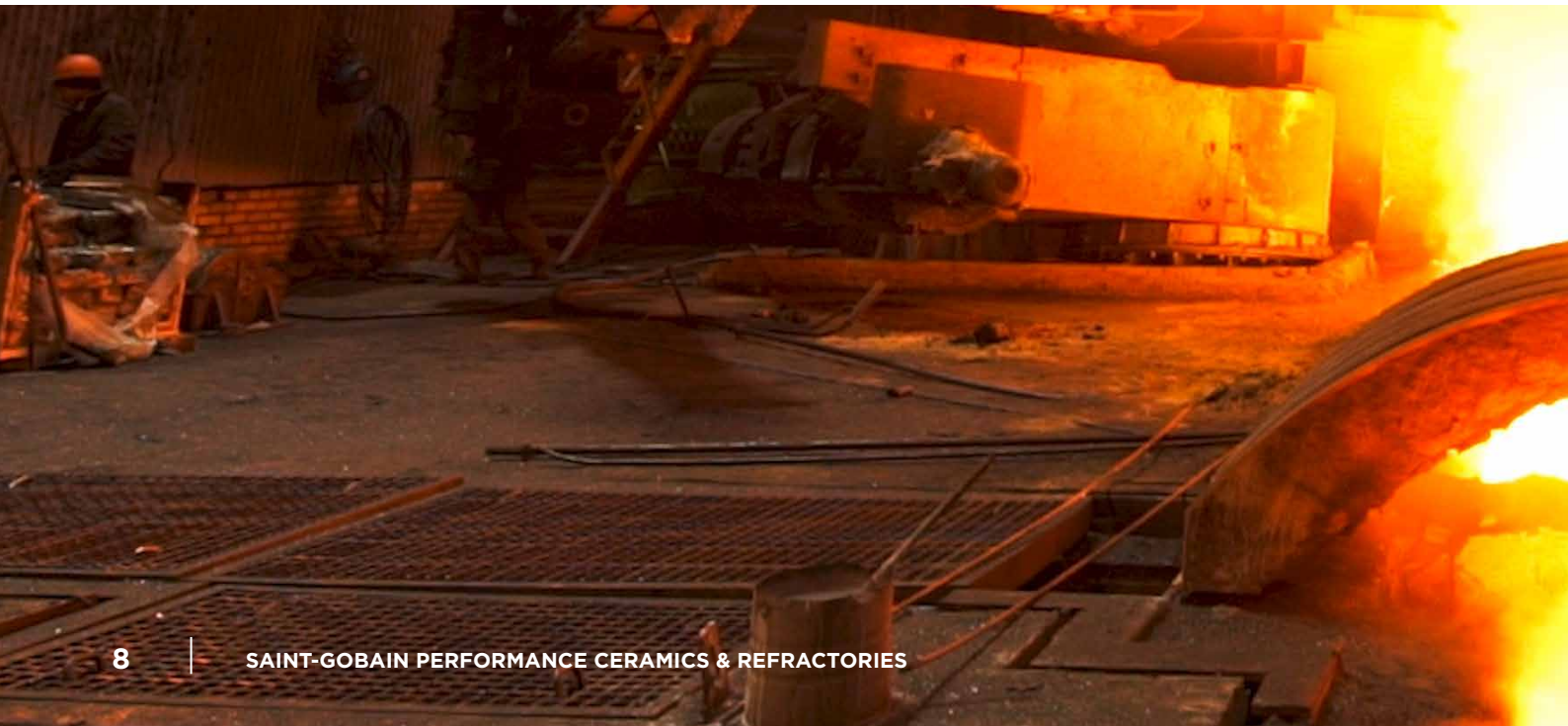
Coke Nose Beam
Wharf Protection Plates

Coke Screen Underflow Hopper

IRON MAKING SOLUTIONS

The iron making process combines all the harsh abrasive materials into one plant making it difficult to operate and maintain reliable raw material and gas systems. Our various time-proven ceramic solutions will take your operation to the next level by helping to reduce the overall cost per ton.





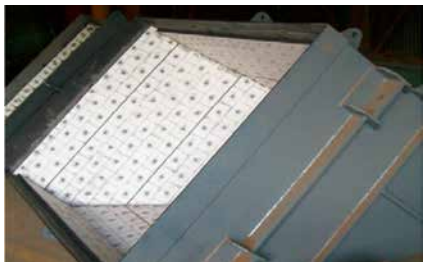
COMPONENTS	APPLICATIONS	MATERIALS
Stockhouse	Conveyor Head Chutes Skirt Boards Vibratory Feeders Flop Gates Weigh Hoppers Screen Feed / Discharge Boxes Skip Cars	Durafrax® Durastrike® ZTA ZAC - Corguard (AZS) Wearfrax® WearPak® / WearFIX®
Blast Furnace	Receiving Hopper Revolving Hopper Lock / Holding Hoppers Diverters / Charge End Sockets Discharge Funnels Conical Sockets Equalizing Relief Piping Uptakes	Durafrax® Durastrike® ZTA Corguard® Wearfrax® Cryston® / Refrax®
Gas Cleaning	Downcomer Elbow & Transitions Axial Cyclone RS Elements Flooded Elbow Level Control Piping Venturi / Dampers	Durafrax® ZAC - Corguard® Norfrax® Wearfrax®
Wastewater	Rotary Vacuum Drum Filter Lined Hi-Flow Valve Piping and Flumes	Durafrax® WearFIX®
Slag Granulation	Tanks Flumes Slag Sand Pipelines Silos	Durafrax® Wearfrax® WearFIX®
PCI - Pulverized Coal Injection	Mill Parts / Classifier Cones Roof Liners: Separator Outlet Coal Cyclones PCI Elbows Orifice Restrictors	Durafrax® Cryston® TW Wearfrax® Hexoloy®

STOCKHOUSE

From the raw material feed belts, to the Blast Furnace skips / feed belt - we have unparalleled application and engineering expertise. Our products offer outstanding abrasion resistance, corrosion resistance and a low coefficient of friction — all requirements for running a low cost stockhouse that contributes greatly to a lowest cost per ton.

Skip Cars

Bins / Silos



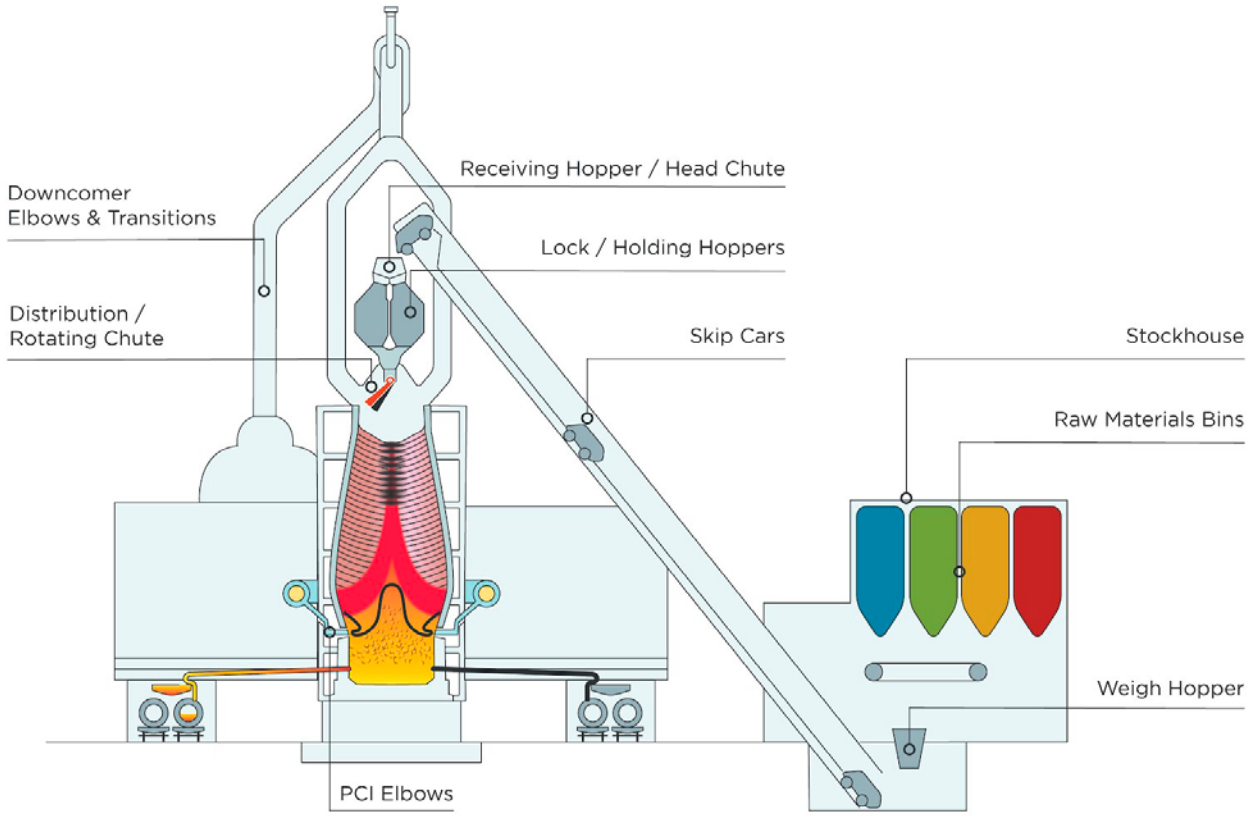
Weigh Hoppers

Flop Gate / Chute

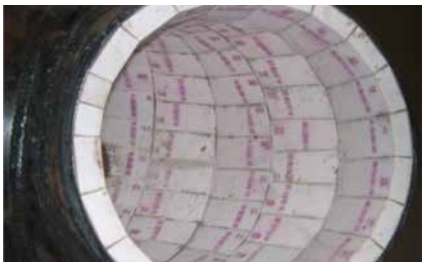
Vibratory Feeders

BLAST FURNACE

The input of raw materials is one of the most important control variables for optimized Blast Furnace operation. The accuracy and reproducibility of the charging process as well as the reliability and ease of maintenance of the charging equipment play a major role. To achieve these goals, we provide tailor-made solutions for every part of the Blast Furnace where wear resistant components are needed.



Receiving Hopper



Relief Elbows

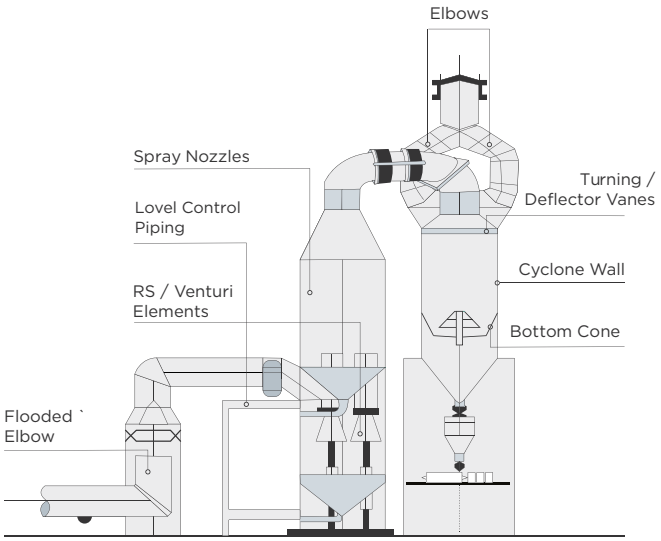
Holding Hopper

Conical Socket

Seal Valve Protector

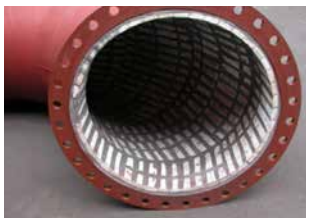
GAS CLEANING

Any downtime in this critical system also shuts down the Blast Furnace. Wear Resistant Technologies has proven ceramic solutions that are predictable, reliable, easily maintainable, cost effective & safe.



RS Elements

Elbow Segments

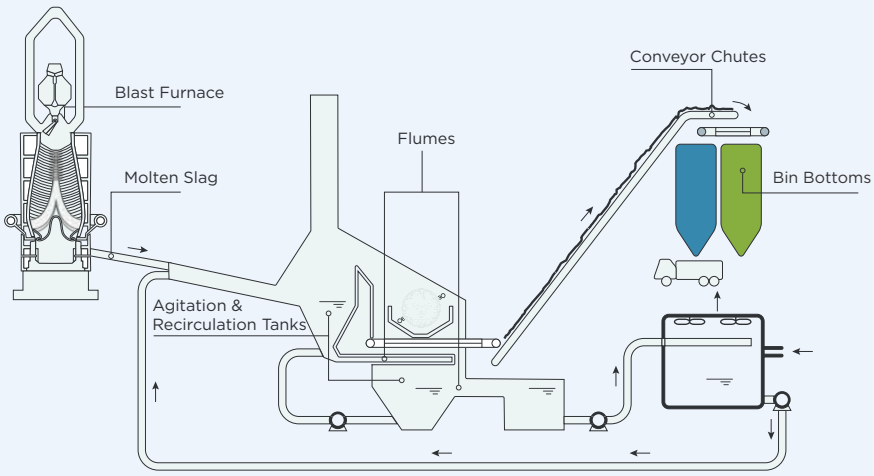


Level Control Piping

Flooded Elbow

SLAG GRANULATION

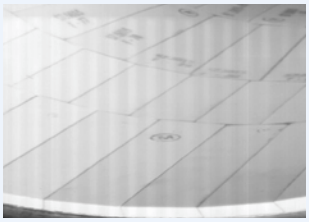
A modern Blast Furnace can produce more than a million tons per annum of slag. When the liquid slag is quenched by cold water, granulation occurs. Relying on our wear resistant lining expertise we have time proven solutions like distributor and slow down box linings, piping, and load out chutes. You can be assured we will apply our experience to assist you in running your plant at optimum levels.



BENEFITS

- Low-cost Metal
- Residue to Resource

Skip Cars

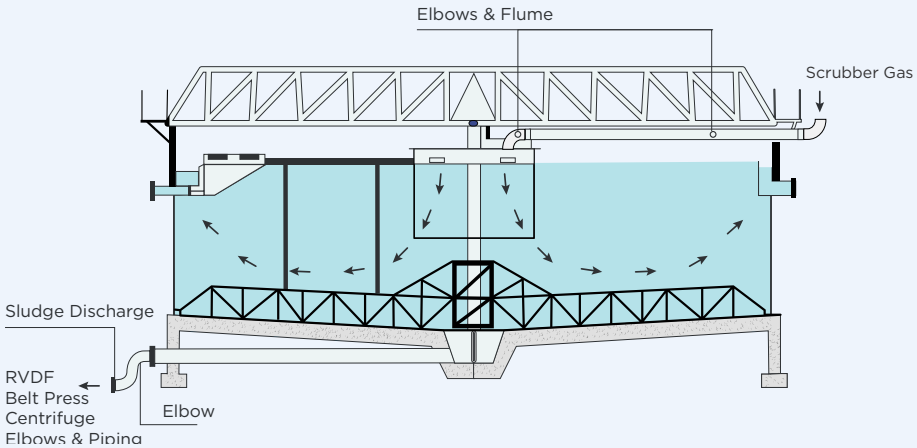


Bins / Silos

Weigh Hoppers

WASTEWATER

Whether it is a complex elbow, lateral, tee or reducer made out of carbon steel, hardened pipe, weld-overlay, nickel alloys, HDPE or rubber, we have designed a lining system to address wear and corrosion problems affecting plant reliability and safety.



Durafrax® Lined
High Flow Valve Feed Splitters

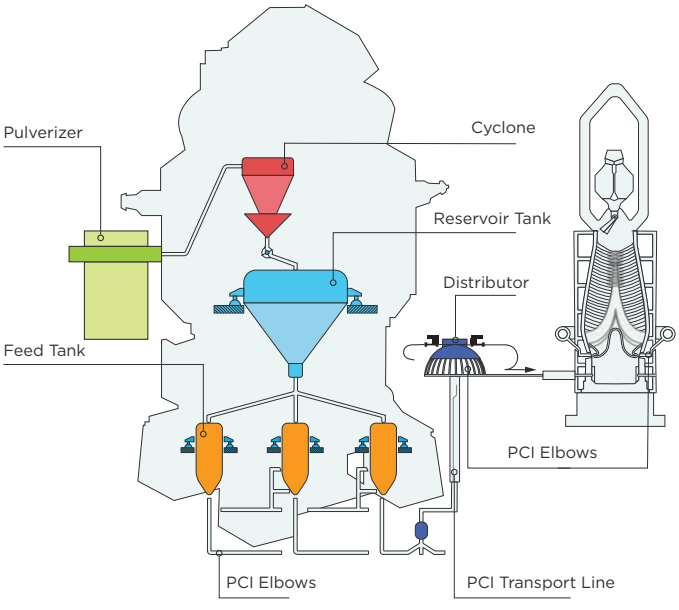
Rotary Vacuum Drum
Filter Drain Line

BENEFITS

- Reduced Downtime
- Excellent Product Quality

PCI

PCI systems are used to lower costs per ton of iron. Listed below are cost effective examples of extending the life of PCI equipment with our ceramic materials.



Elbows

Elbows

Cyclone

Mill Classifier Cone

Elbows

DELIVERING VALUE

Extending the life of equipment and maximizing operational levels for iron & steel applications requires materials that can withstand the harsh conditions. We were pioneers with our Durafrax® linings in the stockhouse applications in the late 1960s'; early 1970s' and that material is widely specified and utilized through the world today. Combined with our practical experience in solving wear problems in ironmaking and associated business units like sinter and coking plants, you can count on the value that 350+ years of experience in ceramic manufacturing offers.

BENEFITS

- Reduced Maintenance Costs
- Increased Profitability
- No Downtimes
- Customized Solutions

PRODUCT CHARACTERISTICS

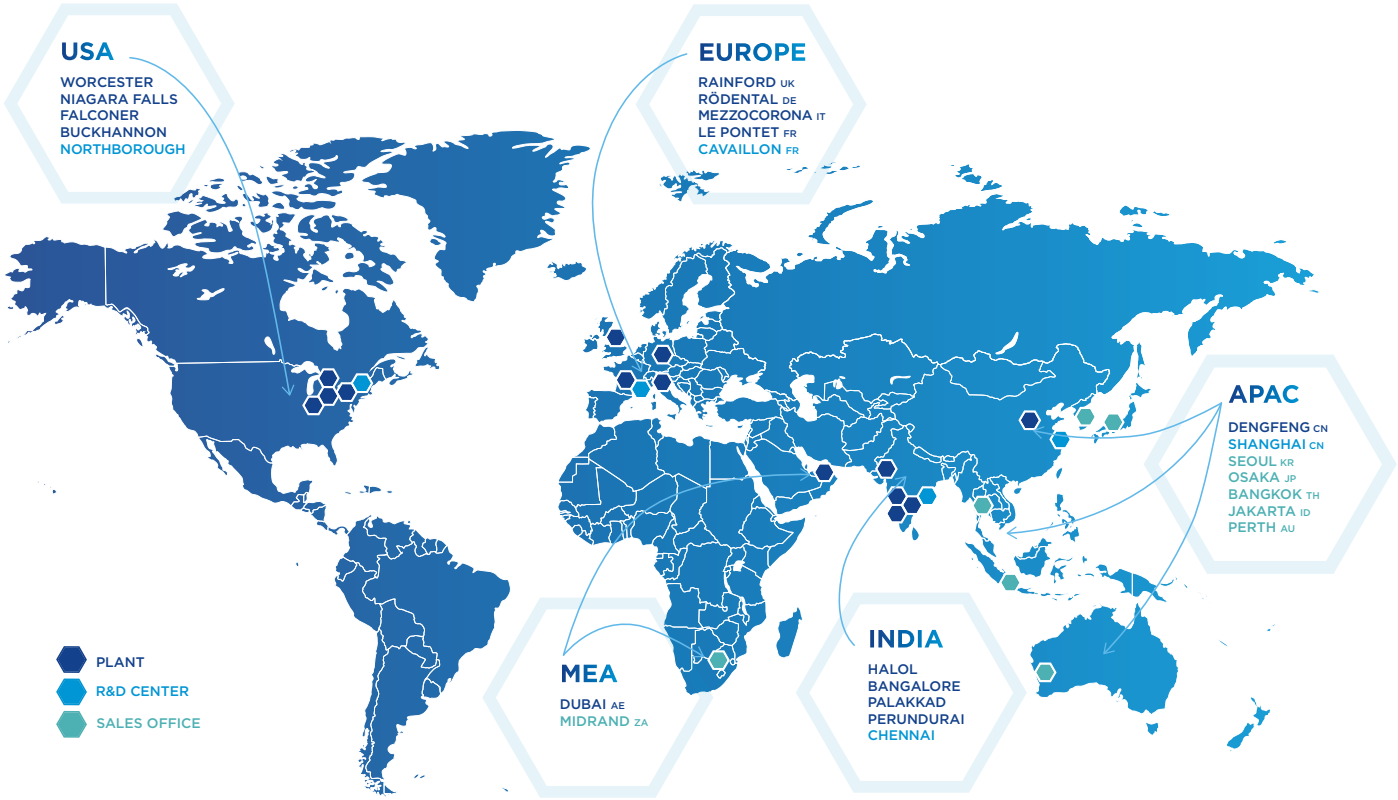
Scale: Superior ++++ | Best +++ | Better ++ | Good +

	Aluminum Oxide (Al_2O_3)	Silicon Carbide (SiC)					
	Alpha Al_2O_3	Nitride Bonded SiC				Reaction Bonded SiC	
	Durafrax®	Cryston®	Cryston® TW	Cast Refrax® 20	Refrax® 20	Norfrax® RB	Silit® SKD
Properties							
Density, g/cm³	3.52	2.77	2.77	2.77	2.62	3.05	3.00
Porosity, %	0	8	<1	15	16	0	0
Thermal Conductivity, W/m·K	18	16.3	23.7	13.8	16.3	125	35
Thermal Expansion, x10⁻⁶/°C	8.3	3.2	4.3	-	4.7	4.3	4.5
Vickers Hardness, GPa	9	23	11,6	-	-	22	-
Abrasion Resistance C704	1.0	1.6	1.5	1.9	2.5	0.7	0.7
Max Use Temp, °C	1250	1590	1450	1450	1590	1350	1380
Performance							
Sliding Abrasion	+++	+	++	+	+	+++	+++
Erosion	+++	+	+	+	+	++	++
Impact	+	++	+	+	+	+	+
Corrosion Resistance	++	++	++	++	++	+++	+++
Thermal Shock	+	+	++	++	++	++	++
Thermal Insulation	+	++	++	++	+++	+	+
Electrical Insulation	++++	N/A	N/A	N/A	N/A	N/A	N/A

	Silicon Carbide (SiC)		Zirconium		Monolithic Castables	
	Reaction Bonded SiC	Sintered Alpha SiC	Zirconia Toughned Alumina	Fused Cast AZS	Silicon Carbide	Aluminum Oxide
	HAMMERfrax®	Hexoloy®	Durastrike® ZTA	ZAC - Corguard®	Wearfrax® RS58	Wearfrax® RA57
Properties						
Density, g/cm³	3.04	3.15	4.20	3.47 (RN) / 3.72 (RT)	2.45	2.80
Porosity, %	1	2	0	1.15 (Skin)	-	-
Thermal Conductivity, W/m·K	125	125,6	-	-	-	-
Thermal Expansion, x10⁻⁶/°C	4.3	4.02	-	-	-	-
Vickers Hardness, Gpa	22	-	-	19.6	-	-
Abrasion Resistance C704	0.7	0.4	0.6	1.1	8.2	7.2
Max Use Temp, °C	1350	1900	1500	1650	500	500
Performance						
Sliding Abrasion	++++	++++	++++	++	+	+
Erosion	+++	++++	++++	++	+	+
Impact	++	+	+++	+++	+	+
Corrosion Resistance	++	++++	++	++	+	+
Thermal Shock	++	++	++	++	++	+
Thermal Insulation	+	+	+	++	++	+
Electrical Insulation	N/A	N/A	+++	++	N/A	N/A

SAINT-GOBAIN PERFORMANCE CERAMICS & REFRACTORIES

OUR GLOBAL PRESENCE



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