SAINT-GOBAIN PERFORMANCE CERAMICS & REFRACTORIES

# BLAST FURNACE

## REFRACTORIES FOR INCREASED SERVICE LIFE

SCAN ME

TO DOWNLOAD

SAINT-GOBAIN

SOLUTIONS TO EXTEND
BLAST FURNACE LIFE-TIME

# IRON MAKING

GENERAL AREAS SERVED

Crude steel production begins with the reduction process, whereby iron ore reacts with carbon sources inside the blast furnace. It is imperative that refractory products used inside the blast furnace are resistant to these thermomechanical and thermochemical reactions.
Saint-Gobain Performance Ceramics & Refractories designs, engineers and supplies a comprehensive range of high quality refractory products and solutions, specifically developed for blast furnaces.

## $CO_2$ SAFE ENERGY, REDUCE $CO_2$ EMMISSION

'INSULATE' YOUR BLAST FURNACE HEARTH

With its insulating effect compared to a pure carbon hearth the Ceramic Cup **reduces the coke consumption and the $CO_2$ emission** at the same time. With the $CO_2$ certificate trading already existing in Europe - for other regions/ countries to come - and with coke prices increasing the money saving effect will become a more and more important factor.

We provide ceramic materials designed to meet your needs:

QUALITY

EFFICIENCY

CUSTOM DESIGN

# BENEFIT FROM OUR SERVICES

## DESIGN & ENGINEERING

### CUSTOMIZED SOLUTIONS

We measure our success with your operating results. To enhance your performance, our team of passionate top skilled engineers are ready to develop the best adapted solutions for your needs.
Our engineers tackle your design challenges with forefront equipment at your service with great experience/knowledge.

- Full BF design including Carbon
- Thermal Calculations using Ansys
- Repairs
- Large Block Size Capability

## R&D FOCUS

### AMONG TOP 100 GLOBAL INNOVATORS

R&D is part of the DNA of the Group, ranked as one of the top 100 innovators in the world. For our ceramics and refractory activity, we invest strategically in innovation to bring you the most efficient solutions developed at Saint-Gobain Research Provence, our center for R&D in Europe with a specialized team dedicated to Blast Furnace application.

## QUALITY SUPPLY

International and global network of divisions and suppliers allow us to access the best quality inputs for our materials. Innovation focuses on material properties to supply solutions specifically adapted to Blast furnace application.

- Top Quality Grades
- Wide Range of Grades

## EXPERTISE

### MORE THAN 50 YEARS OF EXPERIENCE

Rich experience constitutes our total design capability that is unique and unsurpassed, thanks also to the knowledge gained via companies such as Savoie Refractories and Carborundum.

## INSTALLATION

More than 350 references that have built our market recognition

- Supervision
- Technical assistance

## INCREASED LIFETIME

### IMPROVE YOUR BLAST FURNACE LINING

Supplying all required refractory products specifically developed to extend BF lifetime. Unparalleled experience in BF design supply for over 50 years and **several hundred references**, relying on global production capacity with factories positioned worldwide to serve all areas.

Our production facilities are certified by:

- Quality **DIN EN ISO 9001**
- Environment **DIN EN ISO 14001**
- Occupational Safety **OHSAS 18001**

**IMPROVE SERVICE LIFE** OF YOUR BLAST FURNACE

# FULL SUPPLY

Saint-Gobain Performance Ceramics & Refractories has over 50 years of experience in blast furnace refractory design. The company continually develops new and improved materials, adapting to industry trends and evolving customer requirements.

## UPPER STACK

In this low temperature area, abrasion by the solid burden is the primary mode of wear. Our silicon carbide has proven to be cost-effective solution.

**Refrax® 20 SBF**

## LOWER STACK

Abrasion by the coke burden is still a concern but driven by an increasing temperature, in depth attack by Alkali and Zinc vapor become predominant. Our **Refrax® 20 SBF** is a worldwide recognized reference for this application.

**Refrax® 20 SBF / Sicanit AL3 / Alfrax® 85 MS2 A**

## BOSH & BELLY

In addition to Alkali and Zinc attack, the occurrence of molten iron and slag calls for SiAlON bonded materials. We recommended either our silicon carbide **Sicanit AL3** or our Corundum based **Coranit® 3S**. The final decision depends on thermal conductivity requirement (low, to save energy, or high, to promote a protective skull).

**Sicanit AL3 / Coranit® 3S / Refrax® 20 SBF**

## TUYERE BELT

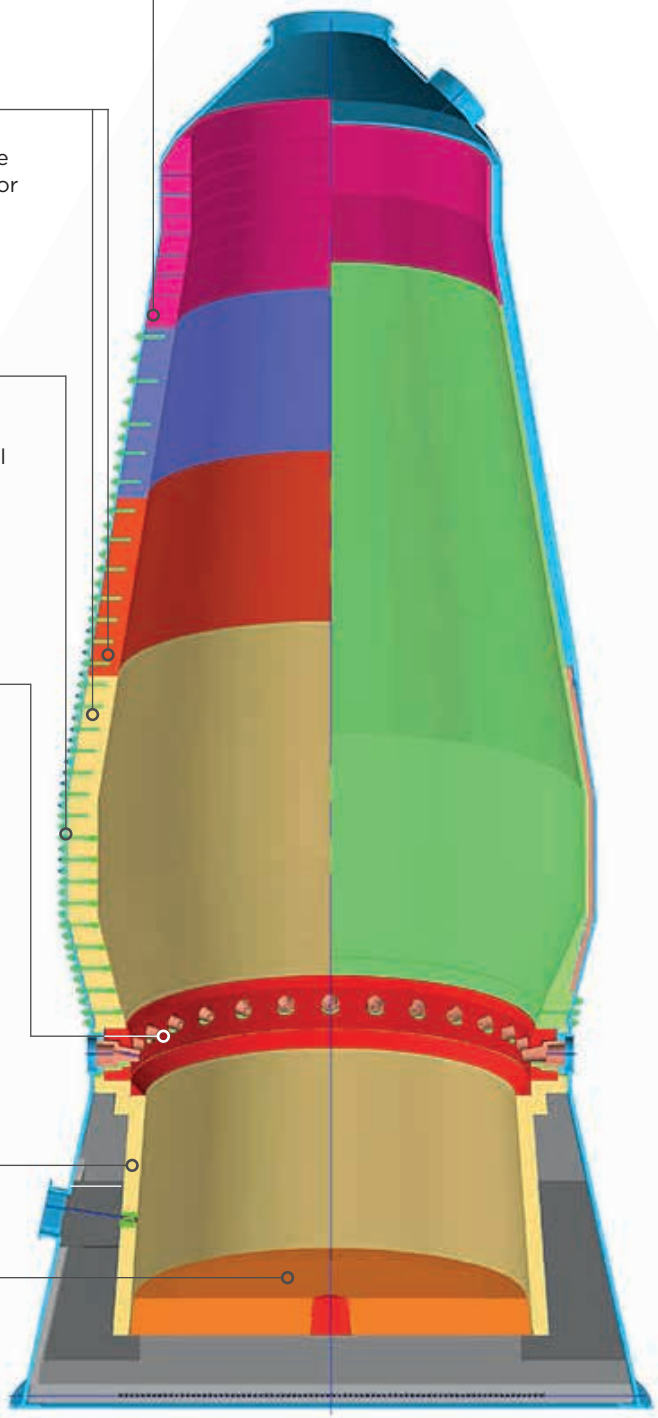
The tuyere sourrundings experience high heat load and thermal shock in combination with corrosion by molten iron and slag and intense Alkali and Zinc vapor attacks. Backed by a unique range of refractory materials, including silicon nitride or SiAlON bonded shapes and pre-formed no and low cement castables, our engineered tuyere sourrounings will fit best to the specific requirements of your Blast Furnace operation.

**MonoCoral / Sicanit TB**

## HEARTH

Traditionally, blast furnace hearths are lined with high thermal conductive carbon-based materials. Placed inside the carbon lining the concept of the **Saint-Gobain Ceramic Cup** is an example where a specific advanced design and material quality render significant benefit to blast furnace operators in terms of lifetime extension and operational efficiency. Beware of cheap copies on the Ceramic Cup. **Design** (avoiding high stress, and items floating off) **Material Quality** (to ensure slow wear) and correct **Installation** all need to be correct to ensure good lifetime.

**Coranit® SlagR / Coranit® AL / Mullfrax® 70 MS4-F**



# OUR PHILOSOPHY - ENHANCING PERFOMANCE

Saint-Gobain has pioneered and promoted "Ceramic Cup" technology since 1982. We have learned a lot over last four decades. We are now into our t**hird generation of design** (SiAlON bonded corundum – "Coranit®") and have recently developed a new improved quality called **Coranit® SlagR**. Detailed feedback from users has shown that the "Coranit®" grade wears very gradually over the lifetime of the hearth. **400 mm thickness** has been shown to last **9 years** or more. After the Ceramic Cup has worn, the carbon then wears quite rapidly until an equilibrium is reached whereby the hot face is sufficiently cooled to allow a **self-protecting "skull"** to form.

Operators are then able to maintain a stable "skull" to **achieve required campaign lifetime**. It has been observed on many occasions however that when the protective "skull" is lost the carbon can be worn away very rapidly resulting in dangerous situations. The **Ceramic Cup** does not depend on a "skull" to achieve its intended lifetime.

We can design your Blast Furnace Hearth using the following PHILOSOPHY:

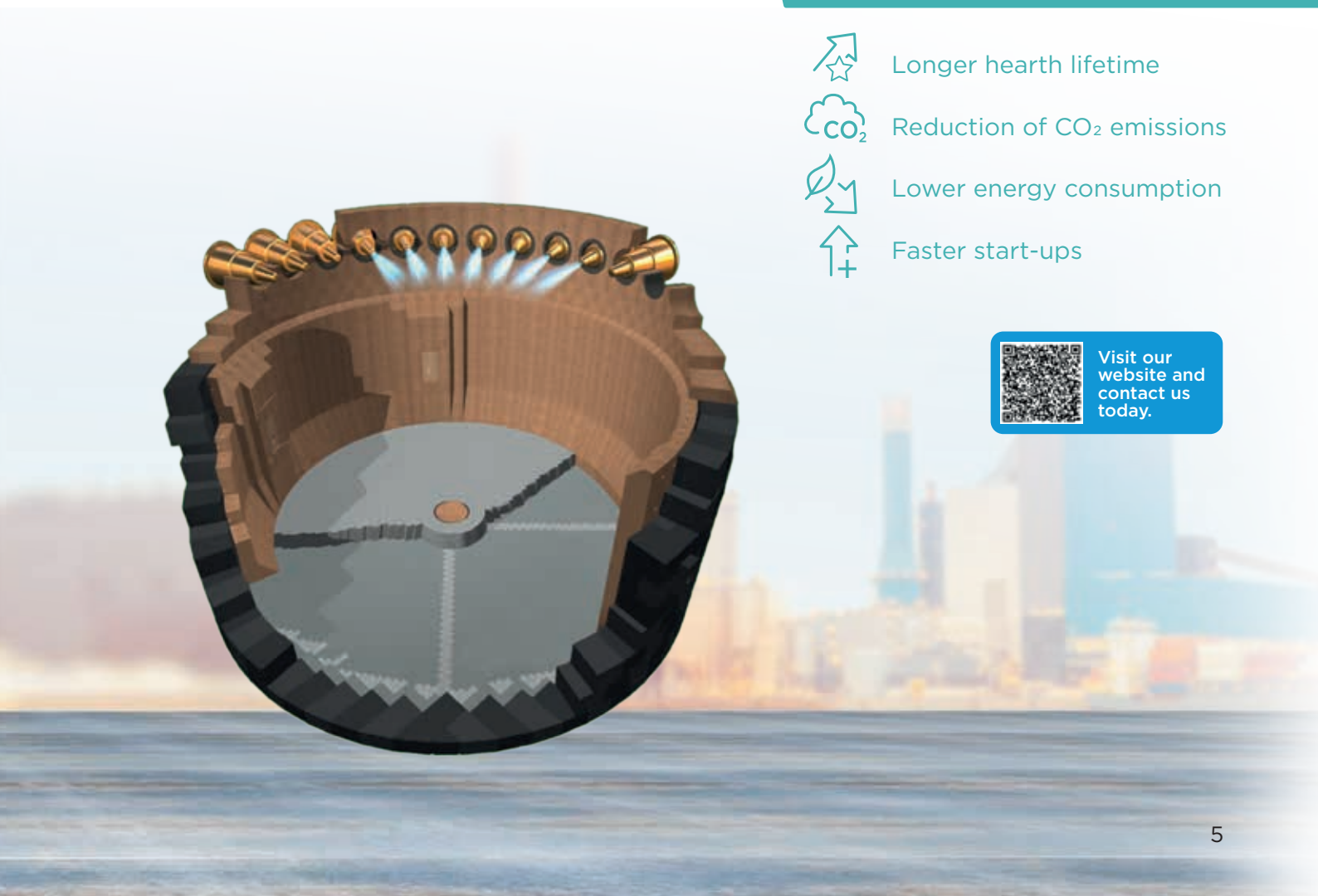
Hot-Face of Ceramic Cup, with just enough thickness of carbon behind to allow a protective "skull" to build-up. No point in having too thick carbon as it will quickly wear to the equilibrium point.

In a perfect world the operator is able to achieve an eternal hearth lifetime by maintaining forever the protective "skull." In this case, there is no need for Ceramic Cup. Unfortunately, we do not live in a "perfect world". Operators get the benefit of maybe 10 years lifetime on the Ceramic Cup before needing to stabilise the "skull" (and avoid water leakages, variable raw materials, unplanned stoppages, large-dense dead-man formation, productivity variations etc.). It is this assurance that operators are given when adopting **SG Ceramic Cup technology**."

## BENEFITS

- Longer hearth lifetime
- Reduction of $CO_2$ emissions
- Lower energy consumption
- Faster start-ups

**Visit our website and contact us today.**



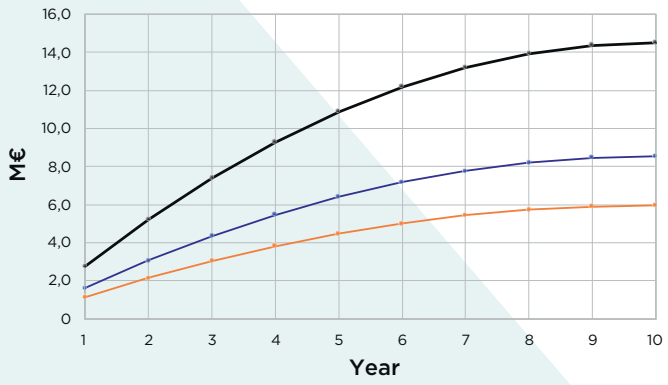
UP TO **59%** ENERGY SAVINGS*

# CERAMIC CUP SOLUTION

Designed to boost the performance of Blast Furnace, withstanding the severe conditions inside Blast Furnace hearth. Applicable also in other parts of BF that face extreme conditions. Heat flow from the hearth wall/bottom are in the ratio of approximately 80:20.

With a Ceramic Cup wall the thermal conductivity of the Coranit® is around 3.5 W/mK at 1000°C whereas many super-micropore carbons are over 20 W/mK. Heat flow at hearth wall drops from around 15 W/m² with carbon to 5 W/m² with a Coranit® Ceramic Cup. It is clear that heat flow reduction is good for the environment, good for economy!

**Ceramic Cup Savings (M€) after "x" years:**




| | |
|---|---|
| TOTAL COKE SAVINGS | 20 kt |
| TOTAL $CO_2$ SAVINGS | 65 kt |

**Graph:**
Case study calculated on an existing blast furnace wih ceramic cup (hearth diameter 11m)

*In hearth with Saint-Gobain Ceramic Cup **Based on a coke price 260 US$/t and $CO_2$ cost 55 €/t

# CERAMIC CUP WALL

Pioneering this solution since 1982, Saint-Gobain recently developed a 3rd generation of Coranit® Ceramic Cup quality with enhanced the characteristics.

## SIALON BONDED CORUNDUM BRICK

**Coranit® SlagR**

- Improved mechanical stability
- Better slag/iron resistance
- Excellent abrasion resistance

**Coranit® AL**

- Iron / slag corrosion resistant
- Good abrasion resistance
- Alkali corrosion resistance

# CERAMIC CUP PAD

Best solutions to protect the bottom of the Blast Furnace, with materials that are highly resistant to Iron.

## HIGH ALUMINA BRICK

**Mullfrax® 70 MS4-F**

Both Mullfrax® 70 MS4 and Mullfrax® 70 are well suited for hearth pad application. Both can be provided in circular and herring bone design.

# TUYERE BELT SOLUTION

Big block tailor-made that can be customized according to your needs. There is no universal quality that has been accepted as recognized solution for tuyere belt, carbonaceous materials as well as SiC or $Al_2O_3$ are used but we suggest our **three top performing materials**. Each operator can decide the best solution depending on what he considers to be the main wear mechanism for his Blast Furnace (refractoriness, slag/iron attack, oxidation attack, alkali attack, abrasion etc.).

### MonoCoral

- The original Ultra-Low Cement **Corundum**
- Big Block with 89% alumina
- Almost 100 references for tuyere and counting


### Sicanit TB

- Pre-assembled sialon bonded SiC bricks
- Combines the properties of SiAlON bonded bricks with same easy and fast installation as for a pre-cast block

# BOSH

As for Bosh application, Sicanit AL3 (SiAlON bonded SiC) with improved alkali and oxidation resistance or Coranit® 3S (sialon bonded corundum) are most often chosen, the latter when low thermal conductivity is required.

Refrax® 20 SBF or Alfrax® 85 MS2 A can also be chosen for lower stack. In addition to alkali and zinc attack, the occurrence of molten iron and slag calls for:

| **Silicon Carbide** | **Corundum** | **Silicon Carbide** |
|---|---|---|
| SiAlON / Nitride bonded | SiAlON bonded | Nitride bonded |
| **Sicanit AL3** | **Coranit® 3S** | **Refrax® 20 SBF** |

# CERAMIC CUP

More than 102 references for Ceramic Cup:

| Year | CUSTOMER | LOCATION | COUNTRY | BF-N. | HEARTH DIA (M) | BOTTOM | CERAMIC CUP |
|---|---|---|---|---|---|---|---|
| **2022** | DK Recycling | Duisburg | Germany | 3 | 5,5 | **Coranit® SlagR** | **Coranit® SlagR** |
| **2022** | Salzgitter | Salzgitter | Germany | A | 11,2 | - | **Coranit® SlagR / Coranit® AL** |
| **2021** | POSCO | Pohang | South Korea | 4 | 14,96 | - | **Coranit® SlagR** |
| **2020** | ArcelorMittal Juiz de Fora | Juiz de Fora | Brazil | 1 & 2 | 4,3 | **Alfrax® 75 TCN** | **Coranit®** |
| **2019** | Isdemir | Iskenderun | Turkey | 1 | 12,5 | - | **Coranit® SlagR** |
| **2019** | Erdemir | Eregli | Turkey | 2 | 10,0 | - | **Coranit® SlagR** |
| **2019** | Baosteel | Baoshan | China | 2 | 14,2 | - | **Coranit® SlagR** |
| **2019** | NLMK | Lipetsk | Russia | 4 | 10,3 | - | **Coranit® AL** |
| **2019** | TISCO Taiyuan | Taiyuan | China | 5 | 14,1 | - | **Coranit® AL** |
| **2018** | Thyssen Krupp Stahl | Schwelgern | Germany | 1 | 13,6 | - | **Coranit® SlagR** |
| **2017** | Voest Alpine Stahl | Linz | Austria | A | 12 | **MS4** | **Coranit® AL** |
| **2016** | ArcelorMittal | Bremen | Germany | 2 | 12 | **MS4** | **Coranit® AL** |
| **2016** | NLMK | Lipetsk | Russia | 6 | 12,3 | - | **Coranit® AL** |
| **2016** | ArcelorMittal | Eisenhüt-tenst. | Germany | 5A | 9,75 | **MS4** | **Coranit® AL** |
| **2015** | Tata Corus Ijmuiden | Ijmuiden | Netherland | 7 | 13,8 | **MS4, MS10** | **Coranit® AL** |
| **2013** | Jindal Steel Power Ltd | Raigarh | India | 1 | 6,5 | **MS4R** | **MonoCoral** |
| **2013** | Dillingen Rogesa | Dillingen | Germany | 4 | 11,2 | **48% $Al_2O_3$** | **Coranit® AL** |
| **2012** | HKM | Huckingen | Germany | B | 11 | **MS4** | **Coranit® AL** |
| **2011** | Bhilai steel | Bhilai | India | 8 | 13,4 | **MS4R** | **Coranit® AL** |
| **2011** | Hyundai | Danjin | South Korea | 3 | 14,8 | **70%$Al_2O_3$ 48%$Al_2O_3$** | **Coranit® AL** |
| **2011** | ThyssenKrupp Stahl | Schwelgern | Germany | 2 | 14,9 | **48%$Al_2O_3$** | **Coranit® AL** |

# TUYERE BELT

139 references since 1986:

| Year | CUSTOMER | LOCATION | COUNTRY | BF-N. | HEARTH DIA (M) | TUYERES |
|---|---|---|---|---|---|---|
| **2023** | ArcelorMittal Gent | Gent | Belgium | A | 11,4 | **MonoCORAL Sicanit TB** |
| **2021** | Voest Alpine Stahl | Linz | Austria | 5 | 8,0 | **MonoGUARD** |
| **2020** | ArcelorMittal Tubarão | Serra | Brazil | 3 | 12,5 | **Refrax® 20 SBF (bricks)** |
| **2020** | ArcelorMittal Juiz de Fora | Juiz de Fora | Brazil | 1 & 2 | 4,3 | **MonoCORAL** |
| **2020** | HKM Mannesmann | Huckingen | Germany | B | 11,0 | **MonoCORAL, inserts Coranit® 3S below Coranit® 3S** |
| **2019** | DK Recycling | Duisburg | Germany | 3 | 5,5 | **MonoCORAL & MonoGUARD** |
| **2019** | ArcelorMittal Gent | Gent | Belgium | B | 10,9 | **Upper Graphite RFH Lower MonoGUARD** |
| **2019** | CSN | Volta Redonda | Brazil | 3 | 13,5 | **Refrax® 20 SBF (bricks)** |
| **2018** | Thyssen Krupp Stahl | Schwelgern | Germany | 1 | 13,6 | **MonoCoral** |
| **2017** | ArcelorMittal | Bremen | Germany | 2 | 12 | **Sicanit TM Sicanit AL3** |
| **2017** | DK Recycling | Duisburg | Germany | 3 | 5,5 | **Sicanit TM** |
| **2016** | EKO Stahl | Eisenhüttenst. | Germany | 5A | 9,75 | **MonoGuard** |
| **2016** | Voest Alpine Stahl | Linz | Austria | 6 | 8 | **MonoGuard** |
| **2014** | Voest Alpine Stahl | Linz | Austria | 5 | 8 | **MonoGuard** |
| **2014** | JSW Dolvi | Dolvi | India | 1 | 13,8 | **MonoCoral** |
| **2014** | SG PAM | Pont à Mous-son | France | 3 | 5,68 | **MonoCoral** |
| **2014** | Voest Alpine Stahl | Linz | Austria | A | 12 | **MonoGuard** |
| **2013** | ArcelorMittal | Newcastle | S.Africa | 5 | 10,14 | **MonoCoral** |
| **2013** | Voest Alpine Do-nawitz | Donawitz | Austria | 1 | 8 | **MonoCoral** |
| **2013** | Jindal Steel Power Ltd | Raigarh | India | 1 | 6,5 | **MonoCoral** |
| **2013** | Dillingen Rogesa | Dillingen | Germany | 4 | 11,2 | **MonoGuard** |
| **2012** | HKM | Huckingen | Germany | B | 11 | **MonoCoral Coranit®** |
| **2011** | Bhilai steel | Bhilai | India | 8 | 13,4 | **Refrax® 20 SBF** |

# BOSH & STACK

128 references for Bosh and 88 for Stack since 1982:

| Year | CUSTOMER | LOCATION | COUNTRY | BF-N. | HEARTH DIA (M) | BOSH | STACK |
|---|---|---|---|---|---|---|---|
| **2023** | Jai Raj Ispat | Hyderabad | India | - | 5,3 | **Sicanit AL3** | - |
| **2023** | Voest Alpine Linz | Linz | Austria | 5 | 8,0 | - | **Sicanit AL3** |
| **2023** | Oyak Isdemir | Iskenderun | Turkey | 3 | 12,5 | **Sicanit AL3** | - |
| **2023** | TATA Iymuiden | Ijmuiden | Netherlands | 6 | 11,0 | **Sicanit AL3** | - |
| **2021** | WELSPUN | Anjar | India | 1 | 5,5 | **Sicanit AL3** | - |
| **2021** | Voest Alpine Stahl | Linz | Austria | 5 | 8,0 | **Sicanit AL3** | - |
| **2020** | ArcelorMittal Taranto | Taranto | Italy | 4 | 10,8 | **Sicanit AL3** | - |
| **2018** | Stelco | Stelco | Canada | 1 | 10,1 | - | **Refrax® 20 SBF KE60** |
| **2018** | TATA Port-Talbot | Port-Talbot | Great-Britain | 5 | 10,8 | - | **Sicanit AL3** |
| **2017** | Voest Alpine Stahl | Linz | Austria | A | 12 | - | **Refrax® 20 SBF** |
| **2017** | USS Gary | Gary | USA | 8 | - | - | **Refrax® 20 SBF** |
| **2016** | ArcelorMittal | Bremen | Germany | 2 | 12 | **Refrax® 20 SBF** | - |
| **2016** | NLMK | Lipetsk | Russia | 7 | 13,1 | **Sicanit AL3** | - |
| **2014** | JSW Dolvi | Dolvi | India | 1 | 13,8 | **Sicanit AL3** | - |
| **2014** | Bhushan Steel Ltd | Orissa | India | 2 | 13 | **Sicanit AL3** | - |
| **2014** | HKM | Huckingen | Germany | B | 11 | **Refrax® 20SBF** | **MS10** |
| **2014** | SG PAM | Pont à Mous-son | France | 3 | 5,68 | **43% Al2O3** | **43% Al2O3** |
| **2013** | Tata steel Ltd | Kalinganagar | India | 1 | 13,9 | - | - |
| **2013** | Voest Alpine Stahl | Linz | Austria | A | 12 | **Coranit®** | - |
| **2013** | ArcelorMittal | Newcastle | S.Africa | 5 | 10,14 | **Refrax® 20 SBF** | - |
| **2013** | Dillingen Rogesa | Dillingen | Germany | 4 | 11,2 | **48% Al2O3** | - |

Derwent Top 100 Global Innovator 2023

Clarivate Analytics

# SAINT-GOBAIN

top EMPLOYER GLOBAL 2023

**1 in 4** products did not exist 5 years ago

**170.000+** employees

2022 sales of **€ 51.2** billion

represented in **76** countries

**-27%** carbon emissions reduction (vs. 2017 on scope 1+2)

**8** main R&D centres

## OUR MISSION

Saint-Gobain designs, manufactures and distributes materials and solutions which are key ingredients in the well-being of each of us and the future of all.

## OUR PURPOSE

**MAKING THE WORLD A BETTER HOME.**


# SAINT-GOBAIN

## PERFORMANCE CERAMICS & REFRACTORIES

## OUR MISSION

To design, develop and **supply solutions** and **services** for **extreme operating industrial conditions.** Our **engineered ceramics** and **refractory** products are manufactured to the **highest industrial standards** and deliver **enhanced performance** while **minimizing environmental impact.**

PIONEERING CERAMIC SOLUTIONS FOR EXTREME INDUSTRIAL APPLICATIONS AND A GREENER WORLD.

# OUR GLOBAL PRESENCE


# CONTACT US


**USA**

**Niagara Falls**

+1 716 278 6233

**Worcester**

+1 508 795 5264

**MIDDLE EAST & AFRICA**

**Dubai (UAE)**

+971 4 8011800

**EUROPE**

**Castellón (Spain)**

+34 9647 303 90

**Corsico (Mi), (Italy)**

+39 0244 851

**Prague (Czech Republic)**

+42 0725 174 478

**Rainford (United Kindom)**

+44 1744 882 941

**Rödental (Germany)**

+49 9563 724 201

**INDIA**

**Bangalore**

+ 91 2676 612 085

**Halol**

+ 91 2676 612 085

**PACIFIC**

**Melbourne (Australia)**

+61 394 745 940

**JAPAN**

**Nagoya**

+81 5619 708 08

**CHINA**

**Dengfeng**

+86 21 6489 999 3

**Shanghai**

+86 1811 633 835 7

**ASIA**

**Seoul (Korea)**

+82 2370 693 34


*Saint-Gobain Performance Ceramics & Refractories plant producing products for Blast Furnaces.

**For more information:** www.ceramicsrefractories.saint-gobain.com
ceramics.refractories@saint-gobain.com

**Follow us on:** www.linkedin.com/company/saint-gobain-performance-ceramics-refractories



PERFORMANCE CERAMICS & REFRACTORIES

SAINT-GOBAIN