Refractories for

STEEL INDUSTRY

Dedicated to Clean Metal
About Us

IFGL Refractories Limited is the flagship company of the S K Bajoria Group, and a leading producer of special refractories for the steel industry, with headquarters at Kolkata, India. The group has diverse business interests and also involved in Insurance Broking, Risk Advisory, TPA Services and Art & Culture.

IFGL has a distinct technological and business focus - Special Refractories and Systems for Steel Industry, and offers total refractory solution for flow control in steel teeming and continuous casting of steel.

The company has grown over the years to become an Indian multinational, with fully owned manufacturing facilities around the globe.

- **IFGL Refractories Limited**, Kalunga (near Rourkela), Odisha, India
- **IFGL Exports Limited**, Kandla, Gujarat, India
- **Monocon International Refractories Limited**, with production facilities at Doncaster (U.K.), Tianjin (China) and Benton Harbour, Michigan, (USA)
- **Hofmann Ceramic GmbH**, at Breitscheid-Erdbach, (Germany)
- **El Ceramics LLC USA**, Cincinnati, USA.

IFGL is considered as one of the most reliable suppliers of refractories for the global steel industry, with exports to more than 50 countries in Europe, Middle East, Africa, South East Asia, Australasia, North & South Americas. It has won several prestigious export awards from Government of India.

**Product Range**

- Isostatic Refractories
- Slide Gate Mechanisms & Refractories
- Purging Plug Mechanisms & Refractories
- Tundish Nozzles
- Monolithics
- Precast Refractories
- Slag Control Systems
- Tube Changer Mechanism (TCM)
- Nozzle Changer Mechanism (NCM)
- Robotic Gunning for EAF & Ladle
- Tundish Lining Refractories
- Refractory Lances

IFGL jointly with Monocon specializes in manufacture, supply and turn-key installation of Tube Changer Mechanism (TCM) for quick change of SES for Slab Casting, and Nozzle Changer Mechanism (NCM) for quick change of nozzles for billet casting.

**El Ceramics LLC**, located in Cincinnati, Ohio, USA, is engaged in manufacturing of Isostatically Pressed Continuous Casting Refractories and caters to the demand of the American markets.

In order to meet the growing demand, in 2012 IFGL started its second state-of-the-art manufacturing facility at the Kandla Special Economic Zone in Gujarat (India) for production of Isostatically pressed Continuous Casting Refractories.
SPECIAL REFRACTORIES FOR
STEEL MAKING

DEDICATED TO CLEAN METAL
GROUP COMPANIES

IFGL REFRACTORIES LTD
Regd. Office: Sector ‘B’ Kalunga Industrial Estate
PO. Kalunga - 770 031, Odisha, India
Head Office: 3, Netaji Subhas Road
Kolkata-700 001, India
Tel: +91 33 4010 6100/ 2248 2411
E-mail : ifgl.ho@ifgl.in

IFGL Exports Ltd.
Plot No-638-644,Kandla SEZ,
PO. Gandhidham
370230, Gujarat

El Ceramics LLC
2600 Commerce Blvd
Cincinnati, Ohio 45241, USA
Tel: +1 513 772 7001, Fax: +1 513 772 7055
Email: jmcintosh@eicermics.com

Monocon International Refractories Ltd
Old Denaby, Doncaster, South Yorkshire,
DN12 4LQ, United Kingdom
Tel: +44 1709 864848, Fax: +44 1709 860481
Email: sales@ifgl-monocon.com
Web: www.monocon.com

MonoCeramics Inc.
Benton Harbor, Michigan
49022, USA
Tel: +269 925 0212, Fax: +269 925 5222
Email: sales@monoceramics.com

Tianjin Monocon Aluminous Refractories Ltd
Tianjin Economic Development Area
Tianjin 300457, P R China
Tel: +86 22 66293245 / 46, Fax: +86 22 66293243
Email: tianjin@ifgl-monocon.com

Tianjin Monocon Refractories Ltd
Tianjin Economic Development Area
Tianjin 300457, P R China
Tel: +86 22 66293245 / 46, Fax: +86 22 66293243
Email: tianjin@ifgl-monocon.com

Hofmann Ceramic GmbH
Mühlweg 14hweg 14
D-35767 Breitscheid-Erdbach, Germany
Tel: +49 2777 9145-0, Fax : +49 2777 9145-55
Email : info@hofmann-ceramic.de
GROUP COMPANIES

About MONOCON
Monocon International Refractories Ltd was established nearly 40 years ago and is located near Doncaster in the north of England.

IFGL acquired Monocon, UK together with its subsidiaries in USA & China in September, 2005.

Monocon products are used extensively throughout the steel industry by many major steel producers.

Areas Of Expertise:
- Slag control system.
- Tundish lining system.
- Secondary Steelmaking applications.
- Continuous casting flow control system.
- Ladle and converter repair system.
- Design, installation and commissioning

About El CERAMICS
El Ceramics LLC is located in Cincinnati (Ohio-USA) and involved in manufacturing of isostatic refractories for continuous casting of steel. IFGL acquired 100% of El Ceramics in September 2010. At present El ceramics products are supplied to major steelmakers in North America. The company has a reputation for supplying high quality products with excellent customer services.

Areas Of Expertise
- Isostatic refractories for continuous casting.

About HOFMANN
Hofmann Ceramic GmbH has been developing and manufacturing innovative technical ceramic solutions for a broad range of applications since 1937. The company has manufacturing bases in Breitscheid (Hessen), Ohio (USA) and Rourkela (India). Hofmann Ceramic is active in all five continents through its own subsidiaries and long-established sales partners.

Areas Of Expertise
- Technical ceramics for the foundry industry.
- High-quality wear-resistant parts for wire and cable industry.
- Refractory heavy-duty ceramics for all types of oven construction.
LADLE SHROUD
Ladle Shroud is used to control the flow of liquid steel from “Ladle to Tundish” and offers protection to steel stream from reoxidation and minimises steel splashes. It has excellent thermal shock resistance to withstand the temperature shock at the start of the cast. Ladle Shrouds are made in Alumina Graphite (Al2O3-C) quality and are isostatically pressed.

✓ Mix used allows 100% cold start.
✓ Length upto 1800mm.

Options
✓ Reverse taper for submerged opening.
✓ Metal can reinforcement.
✓ Argon gas purging (Porous insert or direct injection type).
✓ Ceramic fiber wrapping on outer surface.
✓ Reinforcement in slag zone.
✓ Re-usable type.

SUB ENTRY NOZZLE / SUB ENTRY SHROUD
Sub Entry Nozzle (SEN) / Sub Entry Shroud (SES) is used to control the flow of liquid steel from “Tundish to Mould”. It prevents re-oxidation of steel between the tundish and the mould.

SEN / SES is manufactured in Alumina - Graphite (Al2O3-C) quality and it is isostatically pressed. Special protective coating is applied to provide resistance to decarburisation.

Options
✓ Special reinforcement with Zirconia-Graphite (ZrO2-C) at slag line for excellent slag resistance.
✓ Seating area reinforcement with High Alumina or Magnesia base material.
✓ Special design to prevent Alumina -clogging.
✓ Ceramic fibre wrapping on outer surface.
✓ Gas purging facilities.
✓ Special insulating coating for TCM Sub Entry Nozzle.
ISOSTATIC REFRACTORIES

SEN FOR THIN SLAB CASTING

IFGL offers customized SEN design for Thin Slab Casters. The development of the design involves flow modelling of steel inside the mould.

MONOBLOCK STOPPER

Monoblock Stopper is used to control the flow of metal stream from tundish to mould during continuous casting of steel.

Monoblock Stoppers are made in Alumina-Graphite (Al2O3-C) quality and they are isostatically pressed. Special coating is applied on the surface to provide oxidation resistance and minimise decarburisation.

✓ Length upto 1800mm

Options

✓ Monoblock Stopper for steel foundry applications.
✓ Cross pin or Screw fastening system.
✓ Argon gas purging.
✓ Special reinforcement in tip either with High Alumina, Magnesia or Spinel materials.
**ISOSTATIC REFRACTORIES**

**TUNDISH NOZZLE**

In combination with Monoblock Stopper, Tundish Nozzle controls the flow and protects steel stream before it exits the tundish.

IFGL supplies tundish nozzles for Tube Changer Mechanisms and non-Tube Changer applications with or without argon purging facility.

**TUNDISH METERING NOZZLE**

IFGL offers a comprehensive range of Zirconia (95% ZrO₂) and Zircon (60-75% ZrO₂) tundish metering nozzles, including quick change nozzles.

Composite Zirconia Nozzle  Quick Change Nozzles  Zircon Metering Nozzles

**ISOSTATICALLY PRESSED MAGNESIA CARBON TAPHOLE SLEEVE**

IFGL manufactures Taphole Sleeves for BOF, EAF and EBT furnaces as a single piece and pressed in a high capacity isostatic press with mix of Fused Magnesia and Graphite.

<table>
<thead>
<tr>
<th>L</th>
<th>100 - 2000</th>
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<tbody>
<tr>
<td>d1</td>
<td>50 - 250</td>
</tr>
<tr>
<td>d2</td>
<td>50 - 250</td>
</tr>
<tr>
<td>D1</td>
<td>100 - 500</td>
</tr>
<tr>
<td>D2</td>
<td>100 - 500</td>
</tr>
</tbody>
</table>

**Benefits:**

✓ Single piece is easy to install and maintain.
✓ Improved performance due to elimination of joints.
✓ Uniformly dense body due to isostatic pressing.
✓ Superior erosion and corrosion resistance.
✓ Enhances converter availability by reducing intermittent repairs.
IFGL is a reputed manufacturer of ladle slide gate refractories and mechanisms for the following standard international systems;

- IFGL “FF” and “YPL” Systems.
- Flocon Systems.
- Interstop “LS” System.
- Interstop “QC” and “BK” Systems.

Apart from the above, IFGL also produces slide gate refractories for non-standard systems which are unique to the customers.

**FF- SERIES LADLE SLIDE GATE SYSTEM**

IFGL offers FF-series ladle slide gate system & refractories.

**Benefits of FF System:**

- Simple & Robust.
- High Stroke Length.
- Face Pressure loading.
- Outward Spring Design.
- Optimum Configuration.
- Plate Crack Control.
- High Refractory Life.

### FF 80 Slide Gate Mechanism

<table>
<thead>
<tr>
<th>Model</th>
<th>FF50</th>
<th>FF60</th>
<th>FF80</th>
<th>FF90</th>
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<tr>
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<td>60</td>
<td>80</td>
<td>90</td>
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<tr>
<td>Stroke Length (mm)</td>
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<td>200</td>
<td>200</td>
<td>230</td>
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<tr>
<td>Face Pressure (KN)</td>
<td>60</td>
<td>80</td>
<td>80</td>
<td>100</td>
</tr>
<tr>
<td>No. of Springs</td>
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<td>10</td>
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<tr>
<td>Spring cooling</td>
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<td>Yes</td>
<td>Yes</td>
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</table>
LADLE SLIDE GATE REFRACTORIES & SYSTEMS

FF ladle slide gate system is a two plate linear hydraulically operated gate, with identical fixed and slider plates. The plates have an innovative design based on 3D stress modelling and finite element analysis studies. Crack control in the plates is achieved by special octagonal shape & hot banding, along with special refractory cushion mats. These result in high performance of the plates.

FLOCON SLIDE GATE SYSTEMS
IFGL was the original licensee of Flogates (UK) in India, and have completed more than 200 Ladle installations with Flocon Systems in India & abroad. IFGL offers complete package for Flocon Slide Gate systems, which include design, manufacture, installation and commissioning of equipment, hydraulics and slide gate refractories for ladles.

<table>
<thead>
<tr>
<th>SYSTEM</th>
<th>BORE DIA</th>
<th>STROKE</th>
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<tbody>
<tr>
<td>3150</td>
<td>25mm</td>
<td>76mm</td>
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<tr>
<td>4200</td>
<td>50mm</td>
<td>114mm</td>
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<tr>
<td>6300</td>
<td>75mm</td>
<td>152mm</td>
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</tbody>
</table>

Flocon Slide Gate Refractories

Flocon Slide Gate Plates

Flocon Slide Gate Mechanism
GAS PURGING REFRACTORIES & IPV SYSTEM

IFGL is a leading manufacturer of ladle purging refractories & systems, which include Purge Plugs, Seating Block and Inner nozzle (for IPV system).

**SLOT PLUG**
- Flexible design with different number of slots
- Accurately formed channels separate print
- Slot/channels configuration to suit the customer gas flow requirements.
- Good gas flow control

**SEGMENTED PLUG**
- Better plug life
- High Purging rate
- Easily adjustable gas flow
- Improved wear rate
- Better availability of gas channels
- Regular bubble pattern

**RCA PLUG**
- Excellent resistance to erosion /corrosion
- Channelled tube not wetted by slag
- Smooth slot / channel wall prevents metal fins
- Improved gas flow control
- High performance

**IPV SYSTEM**
IFGL had technical tie up with FLOGATES LTD, UK for IPV Systems (ISID Purgemeister Valve) since 1980 and have long experience in design, supply, installation, commissioning and operation of IPV mechanisms with different international customers.

**Benefits:**
- SAFETY: Virtually zero breakout rate.
- LONGEVITY: Long life minimizes need for mid-campaign ladle bottom repair.
- FLEXIBILITY: Different gas flow rates are possible.
- RELIABILITY: Performance is repeatable. No starting failures. No scheduling delay.
PRODUCTS FROM MONOCON

SLAG CONTROL SYSTEMS
MONOCON has more than 3 decades of experience in BOF Slag Control Systems & Refractories, with 73 machines in operation at 33 steel plants across the globe.

Benefits of Slag Control:
✓ Reduce Slag Carry Over.
✓ Reduce Phosphorous Reversion.
✓ Reduce Aluminium Consumption.
✓ Increase Alloy Yield.
✓ Improve Refractory Performance.
✓ Potential for Yield Improvements.

Key Elements of Slag Control system
✓ Slag Control Dart Machine.
✓ Vessel Angle Indicator.
✓ Infra-red imaging camera and applicators.
✓ BOF Taphole Repair Maintenance.
✓ Pre - Tapping Plugs.
✓ Infrared Slag Control Camera.

Bespoke Slag Control Machine Designs
✓ Roof Mounted.
✓ Pantograph Roof Mounted.
✓ Floor Mounted Side Swipe.
✓ Floor Mounted Turret & Telescopic.
✓ Rail Mounted.
PRODUCTS FROM MONOCON

SLAG DART TECHNOLOGY
Darts float at the metal-slag interface in the BOF and are designed to block the taphole and restrict the amount of slag exiting the vessel. Effective operation is reliant upon the design characteristic of the slag dart and the accurate callibration of the slag control dart machine.
Dart head and tail are designed to withstand temperature, erosion and thermal shock
- Designed shape to suit taphole diameter.
- Density to suit preferred run out time & furnace conditions.
- Tail length and diameter to suit taphole and bath depths.

AUTOMATIC DART LOADING MACHINE

PRE TAP PLUG
The objective of the pre tap plug is to temporarily block the taphole during the turn down and reopen the taphole when steel is presented to the taphole orifice.

THERMAL IMAGING
The Monocon Thermal Image System allows optimization of slag control with the integration of thermal imaging camera into the slag control package.
PRODUCTS FROM MONOCON

TUBE CHANGER MECHANISM (TCM)
In 2006, IFGL-MONOCON signed an exclusive manufacturing & marketing licence with Alcar International Ltd for new generation of Tundish Tube Changer Mechanisms for Slab casters and high performance Argon Injection Tundish Nozzles. Since then we have jointly worked on several successful tube changer projects around the globe.

Benefits
✓ No patent restrictions on machines or refractories.
✓ Penumatic or hydraulic powered.
✓ Easy to install.
✓ Ease of maintenance.
✓ Robust proven design.

IFGL-Monocon Tube Changer Mechanism

TCM H1

TCM H2

NOZZLE CHANGER MECHANISM (NCM)
This device is used to control and shut off the flow of metal to each strand for billet and beam blank casters. The system provides continuous casting technique with additional operational control and flexibility.

Benefits
✓ Extend tundish sequences.
✓ Alternate metering nozzle dia to facilitate casting speed changes as required.
✓ Emergency shut off at the push of a button.
✓ Hydraulic power for smooth and rapid response.
LADLE MONOCATOR
It is a robotically operated machine using sophisticated computer control to target and repair wear areas in the ladle slag line, barrel and ladle bottom including the area around the purge plugs.

Benefits:
✓ Designed for use in hot condition.
✓ Reduces ladle turnaround time.
✓ Increase Ladle availability.
✓ Reduces total refractory costs.
✓ Reduces labour requirement.
✓ Refractory is applied exactly where needed and without waste.
✓ User friendly computer control.
✓ Constant monitoring of the system status i.e. Maintenance, fault diagnosis.

FURNACE MONOCATOR
It is a robotically operated machine using sophisticated computer control to target and repair wear areas in the furnace wall and hearth. This offers a much safer and less labour intensive option than the conventional manual spraying.

Benefits:
✓ Increase Productivity.
✓ Increases furnace availability by reducing furnace turnaround time.
✓ Reduces refractory costs.
✓ Increases furnace life
✓ Refractory application exactly where needed with minimum wastage
✓ No crane required during maintenance.
✓ Programmed maintenance - large selection of pre-programmed patches can be made and sprayed automatically.
✓ All areas can be maintained.
✓ Constant monitoring of the system status i.e. maintenance, fault diagnosis.
TOTAL TUNDISH LINING PACKAGES
MONOCON has extensive experience in the field of tundish refractories and can offer customers with complete tundish packages which can incorporate all or a combination of the following items:

- Monolithic tundish safety lining.
- Basic Tundish working linings (wet spray or dry vibratable).
- Installation equipment (Manual or fully Robotic).

MONOLITE : WET SPRAY TUNDISH LINING
Monolite is a sprayable lightweight magnesia - based coating for the working lining of continuous casting tundishes. Since it is sprayed and not gunned rebound loss is eliminated.

After drying, Monolite has good mechanical and insulation properties together with excellent erosion resistance and deskulling. The composition of Monolite also provides reduced hydrogen pick-up in first “off” cast sections. Monolite is equally suited to both hot and cold tundish practice.

Monocon also manufactures tundish spray machines (semi-automatic, fully automatic and robotic)

MONOVIBE : DRY TUNDISH LINING
MONOCON manufactures and supply a range of both Heat Set and Cold Set Dry Vibratable products with MgO content ranging from 60% to 90%.

- Water free system.
- Reduce Hydrogen pick-up.
- Heat Set/Cold Set options.
- Reduced fuel consumption.
- Environment friendly.
- Low maintenance equipment.
- Low manpower installation.
PRODUCTS FROM MONOCON

MONOLANCE
MONOCON produces lances for different applications in iron and steel making processes. The products involve combination of design innovation and high technology refractory materials tailored to suit all lance applications.

- Desulphurization lances
- Torpedo Ladle lances (Inclined & Vertical)
- Open Transfer Ladle lance
- Metallurgical Powder Injection lances
- Emergency Stirring lances

CUSTOM DESIGNED STEEL EXTENSION

RIGID STEEL CORE
patented design with lightweight construction, providing stability and excellent refractory anchorage.

PROTECTIVE STEEL SHELL
provides initial resistance to thermal shock on first immersion of the lance. Ensure protection in transport and storage

HIGH RESISTANCE POROUS PLUGS
designed to control gas flow-rate and prevent blockage.

MONOLITHICS & PRECAST

✔ Variety of Dense, Low Cement, Ultra Low Cement & Self Flow Castables in 50% to 99% Al₂O₃, category Spinel and Basic quality including a series of Insulating castables.

✔ Wide range of Precast shapes for different areas of applications.

✔ Basic Gunning & Ramming Mass for BOF, EAF, Ladle and other areas.

✔ Mortar & Fixing material for use with Slide Gate Refractories and Purging Refractories.
ENGINEERING
MONOCON provides complete engineering solutions including design, manufacturing, installation and commissioning of bespoke equipment to all sectors of the industry. This is achieved by working closely with customers to fulfil their requirements using the experience and expertise of our engineers.

Design:
MONOCON provides both 2D and 3D designs - simple layouts to complex 3D models and animations.
- 3D modelling.
- Photo-realistic rendered images.
- Animations & Walkthrough’s.
- Concept design and development.
- Sales & Technical presentations.
- Site Layouts.
- 2D draughting & detailing.
- Engineering Calculations.

Electrical:
MONOCON electrical department has a team of highly skilled electrical engineers, with experience in many fields.
- Control Engineering.
- Electrical panel building and installation.
- PLC Programming (Siemens, Allen Bradley, Mitsubishi).
- Development of SCADA and HMI Systems.

Pneumatics / Hydraulics:
The Pneumatics and Hydraulics department provides service for all types of Industry. Pipe work, power packs, installation and fault finding are typical aspects of services provided.
Typical services include:
- Panel design and build.
- Pipe work.
- Hydraulic power packs.
- Circuit diagrams and fault finding.
- Production line automation.
- Hose manufacture.
- Specialists in pneumatic conveying systems.
IFGL REFRACTORIES LIMITED

Head & Corporate Office
3, Netaji Subhas Road
Kolkata - 700 001
India
Tel : +91 33 4010 6100 / 2248 2411
Fax : + 91 33 2243 0886
    + 91 33 2248 0482
E-mail : ifgl.ho@ifgl.in

Registered Office & Works :
Sector ‘B’ Kalungra Industrial Estate
P.O. Kalunga - 770 031
Dist. Sundergarh, Orissa, India
Tel : +91 661 2660195/583/584
Fax : +91 661 2660173
E-mail : ifgl.works@ifgl.in

CIN: L27202OR1989PLC002971

Website : www.ifglref.com, www.bajoria.com