Specific applications need custom made solutions

Typical applications: Need to find materials by function

Wind Turbines

Cast Pipe

Engineering

Automotive

castings.

cation. Ferroglobe provides special metallurgical solutions for heavy section

treatment is necessary to obtain the requested casting specifi-
cation and technical team develop custom made solutions to optimize our cus-
molders’ competitiveness in the casting market.

Inopipe - the key to produce high quality ductile iron pipes

Innovative Ferrous Metal Treatment leads to better mechanical properties

Renewable energy is in our focus

Inopipe - the key to produce high quality ductile iron pipes

Innovative Ferrous Metal Treatment leads to better mechanical properties

Insufficient heat treatment leads to lower mechanical properties
Specific applications need custom-made solutions

Typical applications:
- automotive
- cast pipe
- engineering
- wind turbines

Sophisticated ferrous metal treatment leads to better mechanical properties

Highly skilled technical teams have helped Ferroglobe create a unique range of products and services tailored to customer needs. We offer special solutions for individual requirements, but also to optimize the processes and production costs of the foundry industry worldwide. Hand in hand with the foundry industry worldwide, our R&D and technical team develop custom-made solutions to optimize our customers’ competitiveness in the casting market.

Innovative Foundry Products

FerroPem

Created by the merging of the two industry leaders with complementary profiles.

Worldwide Ferroglobe representatives

Innovative Foundry Products

FerroPem

Created by the merging of the two industry leaders with complementary profiles.

Worldwide Ferroglobe representatives

Mixed Endurance and Technical Investments Over Time

Created by the merging of the two industry leaders with complementary profiles.

Worldwide Ferroglobe representatives

Innovative Foundry Products

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Innovative Foundry Products

FerroPem

Created by the merging of the two industry leaders with complementary profiles.
Specific applications need custom made solutions

- \textit{Wind Turbines}
- \textit{Engineering}
- \textit{Automotive}

Ferroglobe provides special metallurgical solutions for heavy section magnesium treatment to obtain the requested casting specifications. Very often an optimized combination of inoculation and nodulation is necessary to achieve castings with excellent surface quality and microstructure in critical conditions.

- \textit{Renewable energy is in focus}
- \textit{Engineered castings do not tolerate flaws. In order to achieve a high success rate, avoiding casting defects like Chunky Graphite, Inverse Chill etc., Ferroglobe offers a wide range of inoculants and nodularizers to enable foundries and technical team develop custom made solutions to optimize our customers' competitiveness in the casting market.}

- \textit{Innovative Foundry Products}

- \textit{Sophisticated ferrous metal treatment leads to better metallurgical performance}
- \textit{Engineered castings — needs individual solutions}

- \textit{Innovative Foundry Products}

- \textit{Cast Pipe}
- \textit{Engineering}
- \textit{Wind Turbines}

Ferroglobe offers a wide range of inoculants and nodularizers to enable foundries and technical team develop custom made solutions to optimize our customers' competitiveness in the casting market.
Specific applications need custom made solutions

Typical applications need custom made solutions

U3 m. Flügeln

- Wind Turbines
- Engineering
- Cast Pipe
- Automotive

Magnesium treatment is necessary to obtain the requested casting specifications. Very often an optimized combination of inoculation and nodulization can result in better surface quality and microstructure in critical areas. Ferroglobe offers a wide range of inoculants and nodularizers to enable foundries to produce economically sound castings. Ferronorm EU1, FerroSial EU2, and Alloys EU1 are just a few examples of inopipe - the key to produce high quality ductile iron pipes

Inopipe leads to longer pipe wall thickness, increasing the propensity for thinner pipe wall thickness. As the leading worldwide supplier of inoculants and nodularizers, we have taken this challenge head on; designing Inopipe compositions that provide better surface quality and microstructure in critical areas. Inopipe offers high thermal insulating effect of Inopipe leads to longer mold life.

The automotive industry requires castings with higher mechanical properties along with weight reduction. In addition, more complex casting designs are emerging for automotive functions and intricate individual solutions for the production of more lightweight cars. Our products are developed not only to meet these requirements, but also to reduce nitrogen and phosphorus content of castings. Inopipe, Cast Pipe, and FerroPem are just a few examples of innovative cast pipe technology.

Innovative Foundry Products

Innovative Foundry Products

FerroPem

Ferroglobe

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Aurora, IN, USA

Corbin, KY, USA

Alloy, WV, USA

Beverly, OH, USA

Niagara Falls, NY, USA

Les Clavaux, France

Pierrefitte, France

Montricher, France

Les Clavaux, France

Anglefort, France

Pierrefitte, France

Dunkerque, France

Le Grande-Motte, France

Dunkerque, France

Mo i Rana, Norway

Mangshi, China

Puerto Ordaz, Venezuela

Laudun, France

Château Feuillet, France

Shizuishan, China

Police, Poland

New Castle, South Africa

Camargo, Brazil

Camargo, Brazil

Beverly, OH

Niagara, NY

Selma, AL

Alden, KY

Boo, Spain

Camargo, Brazil

Dumbria, Spain

Dénia, Spain

Rocas, Industriales Cuarzos, RAMSA, Spain

Industriales Cuarzos, RAMSA, Spain

Arcillas y Minerales Cuarzos, Industriales Cuarzos, RAMSA, Spain

Hidro Nitro Española SA, Spain

Acquisitions, Divestitures and Selected Investments Over Time

Worldwide Ferroglobe representatives

Selected investments and acquisitions of Ferroglobe lead to a global reach and enable our customers with the most difficult challenges or unique opportunities.

Created by the merging of the two industry leaders with complementary profiles
Inoculants
Effectiveness without side-effects

Our Inopipe® inoculant powders were specially developed for centrifugal casting machines.

- Optimization of the thermal treatment
- Reduction of carbides
- Reduction of surface defects
- Improved pipe stripping
- Protection of the steel mould against thermal shock (increased mould-life)

Inopipe using water cooled moulds.

WIN 4® Bi + La
FESILA® La
SPHERIX® Plus
INOCAST® 100 Al
INOCARB®
ZIRCOGRAF®
SPHERIX® Bi + RE
ZL 80®
AMERINOC® Bi + RE
ZIRCOBAR®
INOCAST® 125
INOCAST® 175

Active Elements
®
Graphite
Sb + RE

Inotube
High nodule count, reduces micro shrinkage
Against micro shrinkage
Minimizes the risk of shrinkage, improves nodularity, recommended for compacted graphite iron
High nodule count, reduces chunky graphite in heavy sections
Avoids chill in grey iron castings, re-activating nucleation
Zr
Features
Avoids chill
Universal inoculants for general use
Ba
High nodule count, reduces chunky graphite in heavy sections

Nodularizers
Changing infrastructure – improving mechanical properties

Available sizing: 0,6–6 mm, 2–10 mm, 5–25 mm; Packing: Big Bag, drum, paper bag

For late inoculation in which the fading phenomenon typically peaks after a certain time.

MOLDINOC 75®
MOLDINOC 65®

Available Weights
Product
20, 40, 60, 80, 150 gr
25, 50, 70, 90, 180 gr

Your satisfaction is our responsibility!
To go head to head with the latest requirements of the foundry industry.
Close cooperations with universities and external R & D facilities allow us to work in the laboratory, but also to test them with our own horizontal pipe spinning machine.
Furthermore, as a leading manufacturer of Mould powders for the ductile iron pipe industry, we are not only able to produce the mould powders in our foundry equipped with induction furnaces, magnesium treatment and Mg treatment or designed to solve specific technical problems at our laboratory, but also to test them with our own horizontal pipe spinning machine.

Inoculant ingots and cored wires
Sophisticated solution reserved for process control

Ferroglobe produces a wide range of nodularizers in 3 different plants on 3 continents to give our customers the ability. All wires are made according to customer specifica-
tions or designed to solve specific technical problems at our laboratory, but also to test them with our own horizontal pipe spinning machine.

Monitored process control.

Innovation, expertise and advice
Ferroglobe’s R & D

Our FILCAST® inoculant ingots are manufactured with graphite and silicon for the production of ductile iron. They are produced using a patented process which ensures a good chemical and mechanical balance. Our FILCAST® inoculant ingots are supplied in the form of cast ingots, rods, or wires. They are available in different sizes and weights, up to 10 kg.

Uniform treatment – improving mechanical properties
Nodularizers – Technology for the future

For magnesium treatment and inoculation
Composed for your special needs

Typical effects of Ferroglobe inoculants
Effects and behavior

<table>
<thead>
<tr>
<th>Nodularizer</th>
<th>Grey Iron</th>
<th>Universal</th>
<th>Ductile Iron</th>
<th>Thin Wall</th>
<th>Various Sections</th>
<th>Heavy Section</th>
<th>Nodule Count</th>
<th>Preconditioning</th>
<th>Against Shrinkage</th>
<th>Fading Time</th>
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</thead>
<tbody>
<tr>
<td>MOLDINOC 75</td>
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<tr>
<td>SPHERIX Bi + RE</td>
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</tbody>
</table>

Evaluation of the foundry experienced
Inoculants
Effectiveness without side effects

Inopipe® inoculant powders were specially developed for centrifugal casting machines.

Packing:
- Big bag
- Drum
- Paper bag

All our inoculants are available in the standard sizes 2-7 mm, 0,5-2 mm, 0,2-0,7 mm. Other sizes are available upon request.

- Optimization of the thermal treatment
- Reduction of carbides
- Reduction of surface defects
- Improved pipe stripping
- Protection of the steel mould against thermal shock (increased mould-life)

Inopipe® using water cooled moulds.

Nodularizers
Sophisticated nodulizer powders for ductile iron pipes

CERINOC® Ce

SPHERIX® Plus

INOCARB®

ZIRCOGRAF®

SPHERIX® Bi + RE

AMERINOC® Bi + RE

INOCAST® 125

INOCAST® 175

Product
Active Element

®

Graphite

Sb + RE

High nodule count, reduces micro shrinkage

Against micro shrinkage

Minimizes the risk of shrinkage, improves nodularity, recommended for compacted graphite iron

High nodule count, reduces chill in thin wall castings, reduces chunky graphite in heavy sections

Avoids chill in grey iron castings, re-activating nucleation

Universal inoculants, fade resistant, appreciated for medium and heavy sections

Zr

Universal inoculants for general use

High nodule count, reduces chunky graphite in heavy sections

Features

Avoids chill

Universal inoculants, fade resistant, appreciated for medium and heavy sections

Inoculants and cored wires

Sophisticated metal treatment for process control

Ferroglobe's R & D

Innovation, expertise and advice

Ferroglobe's R & D

Our FILCAST® inoculant ingots can be delivered in 4 sizes of 20, 40, 60, 80 gr. We also produce mould inserts with different weights up to 10 kg. The growth of our customers’ needs is our motivation. We have developed MOLDINOC® inoculant ingots to give our customers the possibility to go head to head with the latest requirements of the foundry industry.

In the most modern and advanced foundry equipped with induction furnaces, magnesium treatment and separated test-moulds, we are able to test the new product developments and develop new materials. These new materials serve us for testing directly in our R & D foundry equipped with induction furnaces, magnesium treatment and separated test-moulds. These new product developments respond to raising requirements in the foundry industry and translate them to new foundry products. Consequently, the new development is not just experimental, but our laboratory equipment is also translated into the production line in cooperation with iron pipe industry. The new development is not just experimental, but our laboratory equipment is also translated into the production line in cooperation with the iron pipe industry and meets the need for custom made solutions in foundries. More complex castings along with higher mechanical properties increase the necessity of high quality relevant active elements and investigation casting defects. Ferroglobe’s R & D foundry equipped with induction furnaces, magnesium treatment and separated test-moulds.

Consequently we do not stop there, as we have understood that the foundry industry needs more innovative products. Our R & D is close cooperations with universities and external R & D facilities allow us to go head to head with the latest requirements of the foundry industry.

Close cooperations with universities and external R & D facilities allow us to translate the latest research to foundry practice. Our latest laboratory technology is monitored process control.

Sophisticated metal treatment for process control

Effects and behavior
Typical effects of Ferroglobe inoculants
**Inoculants**
Effectiveness without side effects

Our Inopipe® inoculant powders were specially developed for centrifugal casting machines. They are available in the standard sizes 2-7 mm, 0.5-2 mm, 0.2-0.7 mm. Other sizes are available upon request.

For the production of cast iron pipes:
- Reduction of surface defects
- Improved pipe stripping
- Protection of the steel mould against thermal shock (increased mould-life)

**Inopipe**
- WIN 4® Bi + La
- FESILA® La
- CERINOC® Ce
- SPHERIX® Plus
- INOCAST® 100 Al
- INOCARB®
- SPHERIX® Bi + RE
- ZIRCOBAR®
- INOCAST® 125
- INOCAST® 175
- LMC®

**Active Element**
- Graphite
- Sb + RE

**Nodularizers**
Available sizing: 0.6-6 mm, 2-10 mm, 5-25 mm; Packing: Big Bag, drum, paper bag

**Features**
- Avoids chill
- High nodule count, reduces chunky graphite in heavy sections
- Universal inoculants, fade resistant, appreciated for medium and heavy sections

**References**

**Ferroglobe’s R & D**
Innovation, expertise and advice

Our FILCAST® wire products can be used to ensure just-in-time manufacturing allows for rapid composition changes thereby rapidly reducing foundry scrap and on one with customers designing nodularizer compositions to optimize individual foundry operations. Our quick segregation, improving the FeSiMg microstructure and performance. Furthermore we take pride in working one safety in supply and quality. Below we have listed some standard grades. We use thin casting technology, avoiding

**MOLDINOC® Inoculant Ingots**
Composed for your special needs

**Product**

<table>
<thead>
<tr>
<th>Product Code</th>
<th>Composition</th>
<th>Relaxation Mg (wt%)</th>
<th>Si (wt%)</th>
<th>Ca (wt%)</th>
<th>Al (wt%)</th>
<th>Reference Mg Si Ca Al RE</th>
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<tbody>
<tr>
<td>MOLDINOC 57 5</td>
<td>54 49 1 &lt; 0,8</td>
<td>54 49 1 &lt; 0,8</td>
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<tr>
<td>MOLDINOC 57 6</td>
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<td>54 49 1 &lt; 0,8</td>
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</tr>
</tbody>
</table>

**Innope® and Inotube® Inoculant Powders**
For the production of cast iron pipes

**Features**
- Composed for your special needs
- For late inoculation

<table>
<thead>
<tr>
<th>Product</th>
<th>Use</th>
<th>Composition</th>
<th>Porosities N</th>
<th>Against Chill</th>
<th>Nodule Count</th>
<th>Various Sections</th>
</tr>
</thead>
<tbody>
<tr>
<td>MOLDINOC 75®</td>
<td>For late inoculation</td>
<td>25, 50, 70, 90, 180 gr</td>
<td>20, 40, 60, 80, 150 gr</td>
<td>Heavy Section</td>
<td>9 47 3 &lt; 0,8 1</td>
<td>Grey Iron</td>
</tr>
</tbody>
</table>

**Effects and behavior**
Typical effects of Ferroglobe inoculants

<table>
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<th>Product Code</th>
<th>Description</th>
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<td>Heavy Section</td>
<td>9 47 3 &lt; 0,8 1</td>
<td>Grey Iron</td>
<td></td>
</tr>
</tbody>
</table>

**The use of MOLDINOC® inoculant ingots is made by an injection or impact method from the mould into the metal at a temperature of 1200°C or higher.**

**MOLDINOC® inoculant ingots**
Composed for your special needs

**Product**

<table>
<thead>
<tr>
<th>Product Code</th>
<th>Composition</th>
<th>Relaxation Mg (wt%)</th>
<th>Si (wt%)</th>
<th>Ca (wt%)</th>
<th>Al (wt%)</th>
<th>Reference Mg Si Ca Al RE</th>
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</tbody>
</table>

**Innoculants**
Effectiveness without side effects

Inopipe® inoculant powders were specially developed for centrifugal casting machines. Packing: Big bag, drum, paper bag

All our inoculants are available in the standard sizes 2-7 mm, 0.5-2 mm, 0.2-0.7 mm. Other sizes are available upon request.

For the production of cast iron pipes:
- Reduction of surface defects
- Improved pipe stripping
- Protection of the steel mould against thermal shock (increased mould-life)

**Inopipe**
- WIN 4® Bi + La
- FESILA® La
- CERINOC® Ce
- SPHERIX® Plus
- INOCAST® 100 Al
- INOCARB®
- SPHERIX® Bi + RE
- ZIRCOBAR®
- INOCAST® 125
- INOCAST® 175
- LMC®

**Active Element**
- Graphite
- Sb + RE
Inopipe® inoculant powders were specially developed for centrifugal casting machines.

- **Packing**: Big bag, drum, paper bag
- Available in standard sizes 2-7 mm, 0.5-2 mm, 0.2-0.7 mm. Other sizes are available upon request.

**For the production of cast iron pipes**

- **Optimization of the thermal treatment**
- **Reduction of carbides**
- **Reduction of surface defects**
- **Improved pipe stripping**
- **Protection of the steel mould against thermal shock (increased mould life)**

**InoPipe® using water cooled moulds.**

**FESILA® La**

**CERINOC® Ce**

**SPHERIX® Plus**

**INOCAST® 100 Al**

**INOCARB®**

**ZIRCOGRAF®**

**ZL 80®**

**AMERINOC® Bi + RE**

**ZIRCOBAR®**

**INOCAST® 125**

**INOCAST® 175**

**LMC®**

**Active Element**

**Product**

**Features**

- **High nodule count, reduces micro shrinkage**
- **Against micro shrinkage**
- **Minimizes the risk of shrinkage, improves nodularity, recommended for compacted graphite iron**
- **High nodule count, reduces chill in thin wall castings, reduces chunky graphite in heavy sections**
- **Avoids chill in grey iron castings, re-activating nucleation**
- **Universal inoculants, fade resistant, appreciated for medium and heavy sections**

**Inoculants**

**Effectiveness without side effects**

**Nodularisers**

**Changing infrastructure – improving mechanical properties**

**Inoculants and cored wires**

- **Sophisticated need for process control**

**MOLDINOC® Inoculant Ingots**

- **Composed for your special needs**

**Inoglobe’s R & D**

**Innovations, expertise and advice**

**Ferroglobe’s R & D**

**Our FILCAST**

**Composed for your special needs**

**Inopipe® and Inotube® inoculants provide**:

- **High nodule count, reduces chunky graphite in heavy sections**

**Ferroglobe’s a D D**

**Inoculants’ and Nodularisers’ beneficial effects**

**Effects and behaviour**

Typical effects of Ferroglobe inoculants