

Desulco®



SUPERIOR  GRAPHITE

Company History

The Superior Flake Graphite Co. was founded in 1917 by William J. Carney to operate a mine in Alabama in order to address the need of domestic graphite sources during World War I. In 1945, the Alabama mine was replaced by operations in Mexico, and in 1954, the company changed its name to Superior Graphite Co. In 1960, Peter Carney, grandson of the founder took over as President. After a long research and development period, a patent on the Desulco® process was earned; in 1977, the first ton of Desulco® was produced. From this date onward the production capacity has been continuously increased in response to growing market needs for consistent, high quality recarburisers. In 1994, the company opened its new factory in Sweden, to supply product to customers in Europe, Asian countries and South America. Since 1998, **Edward Carney** has been appointed as President and CEO of Superior Graphite Co.

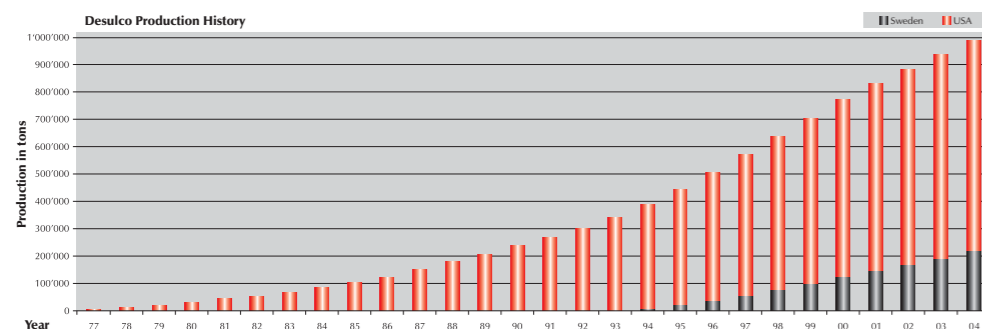


Market Leader of Manufactured Recarburisers

Superior Graphite Co. operates high temperature purification furnaces in Hopkinsville, Kentucky USA, with a yearly capacity in excess of 60'000 metric tons and a similar production facility with capacity for an additional 30'000 metric tons annually in Sundsvall, Sweden. With this high capacity, Superior Graphite is by far the world's largest producer of manufactured recarburisers.

25 Year Anniversary

2002 marked a milestone in Superior Graphite's history with the celebration of the 25th anniversary of Desulco®. To date both Superior Graphite Co. and Superior Graphite Europe Ltd. have supplied customers worldwide in excess of **1'000'000 tons** of Desulco® without ever recording a non-conformance related to product purity or quality.



Product Specification

Grade 9001 Particle Size 0,20 mm – 9,50 mm

Covers the complete size spectrum from 0,20 mm – 9,50 mm and is the **ideal charge carbon** for induction furnace melting.

Grade 9005 Particle Size 1,40 mm – 9,50 mm

Is typically used as recarburiser for steel and other ferrous applications, which require coarse particles.

Grade 9007 Particle Size 0,60 mm – 9,50 mm

A specially developed recarburiser for **high carbon steel** applications where hydrogen, nitrogen, and sulfur contamination needs to be avoided and high carbon yields are expected.

Grade 9010 Particle Size 0,20 mm – 4,75 mm

Ideally sized for **foundries**, which wish to avoid particles > 4,75 mm.

Grade 9012S Particle Size 0,60 mm – 4,75 mm

Is appreciated by foundries, which are looking for **rapid carbon dissolution** and high carbon recovery.

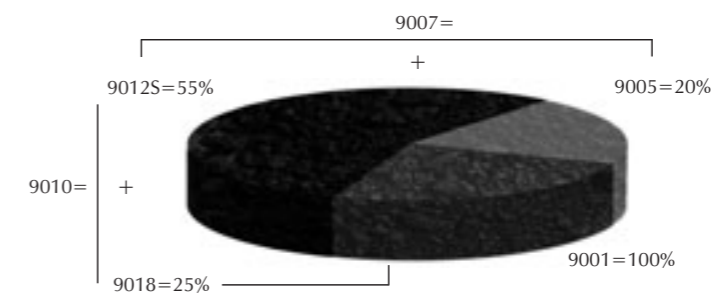


Grade 9018 Particle Size 0,18 mm – 0,85 mm

Designed for very special requirements, such as **carbon injection, ladle trim, rotary furnace** and additions that demand a small particle size.

| Element | Typical |
|----------|---------|
| Carbon | 99,9 % |
| Sulfur | 0,014 % |
| Nitrogen | 42 ppm |
| Hydrogen | 10 ppm |

Desulco® production capabilities by grade



9001

9005

9007

9010

9012S

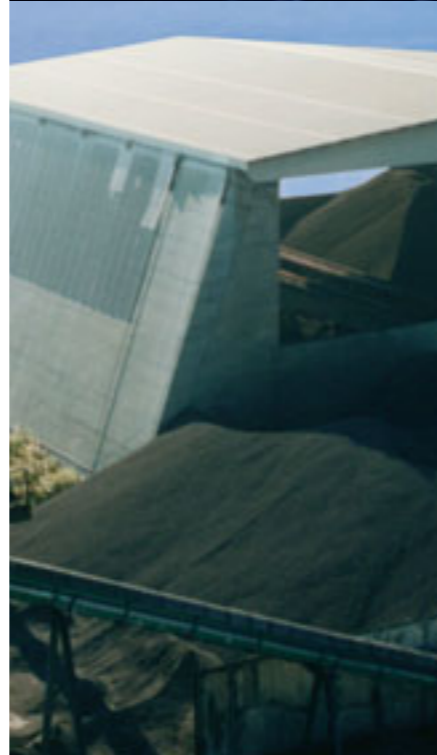
9018

The Desulco[®] Process – a patented technology –

Desulco[®] is produced with Superior Graphite Co.'s patented high temperature furnace technology. This continuous process purifies the raw material at temperatures in excess of 2760 °C, resulting in the final product, Desulco[®]. Due to its extremely high purity, its particle morphology, its extremely high resiliency and graphitic crystalline structure, Desulco[®] is a **unique** type of carbon.

Incoming Coke

The raw material, a specially selected and specified calcined petroleum coke, is delivered to the manufacturing plants in large batches. Ocean vessels supply the raw material to the operations in Sundsvall/Sweden, and barges and trucks ensure the raw material supply to the plant in Hopkinsville/USA. The raw material is kept in covered storage to protect the feedstock material. All incoming raw materials are tested, to ensure that only 100% in-specification raw material is supplied to the manufacturing process. Special attention is given to monitor the chemistry, particle size and morphology. Prior to its introduction into the furnaces, the raw material is crushed, screened and blended to the appropriate size distribution. Any fines remaining in the mix are vaporized in the furnace ensuring that Desulco[®], is virtually free of fines.



Thermal Purification

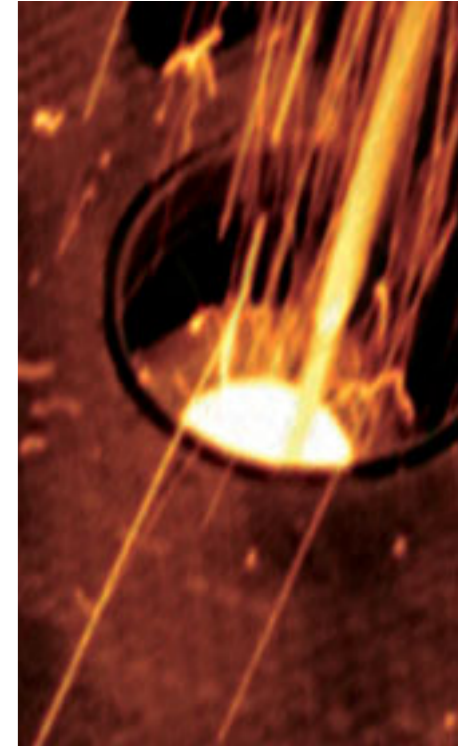
The unique high temperature, continuous, electro-thermal manufacturing process exposes the raw material to temperatures exceeding 2760 °C. Impurities or contaminants such as sulfur, moisture, ash, volatiles, and gases (hydrogen, nitrogen and oxygen) are eliminated. Simultaneously, the coke is graphitised enhancing the chemical purity and morphology creating a granular carbon. The concentration of critical elements is tested at regular intervals. If a deviation from the standards is recorded, the material is immediately reprocessed.

Packaging

After thermal purification, Desulco[®] is sized to meet the various particle size specifications. Finally, the chemical composition and sizing are recorded and reported in a certificate of analysis, which is sent to the customer with every shipment. Desulco[®] is available in custom packaging based on customer requirements. Prior to dispatch, a final quality check of packaged product is undertaken to ensure that only defect-free products are shipped. All bags are marked for tracing purposes.

Quality Assurance

Superior Graphite Co.'s ISO certified quality systems ensure a high consistency and reproducibility, bag-to-bag, pallet-to-pallet, and truckload-to-truckload that cannot be matched by petroleum and acetylene coke, and other by-products such as graphite electrode scrap.

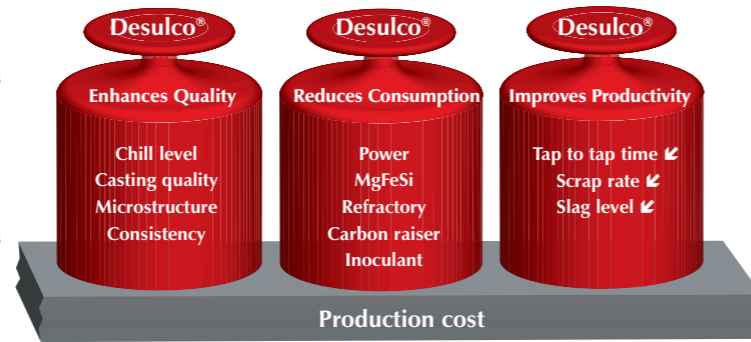


Desulco® Iron Foundry Applications

Charge carbon, trimming, ductile iron pre-treatment and grey iron inoculation.

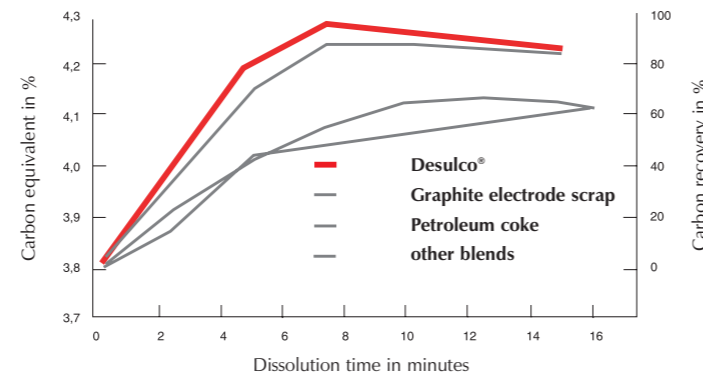
Total Cost Reduction

The morphology, chemistry and crystallinity of re-carburisers have a major impact on the overall casting cost. The combined application and cost benefits, which are derived through the use of Desulco®, enable foundries to manufacture castings in a highly cost effective manner.



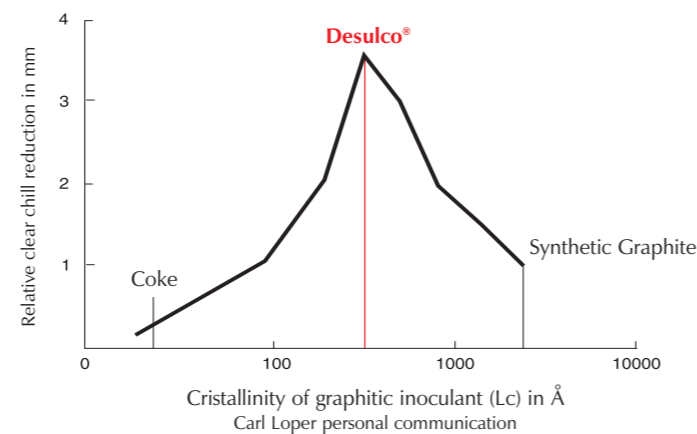
Carbon Recovery

In comparison with calcined petroleum coke, acetylene coke and graphite electrode scrap, Desulco® yields the highest carbon recovery and fastest dissolution time.



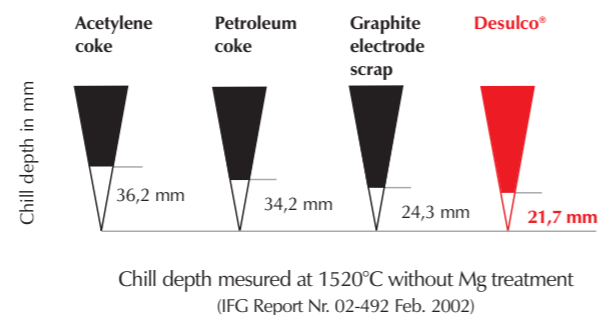
Nucleating Effect

In 1996, Prof. Carl Loper, University of Wisconsin-Madison, studied the inoculating influence of re-carburisers, by determining the chill depth of grey cast iron using various re-carburisers with differing crystallinity such as petroleum coke or graphite electrode scrap. It was discovered that the crystallinity of Desulco® showed the biggest nucleation improvement of the melt, resulting in a maximum chill depth reduction.



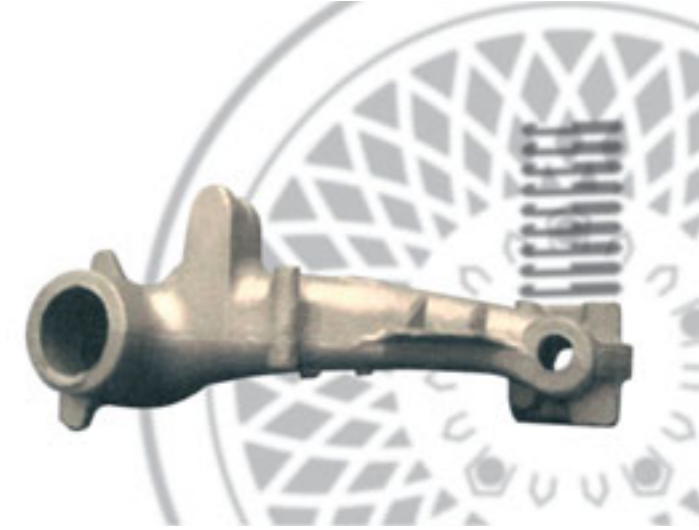
Germination Effect

A study on commercially available re-carburisers conducted by the foundry research institute IfG in Düsseldorf Germany, has shown that graphitic materials such as Desulco®, and to a lesser extent milled graphite electrodes, enhance the nucleating state of molten iron and subsequently reduce the chill depth measured on a chill wedge. Amorphous carbons such as acetylene and petroleum coke do not contribute to the nucleation of the melt, resulting in a stronger chill tendency of the iron.



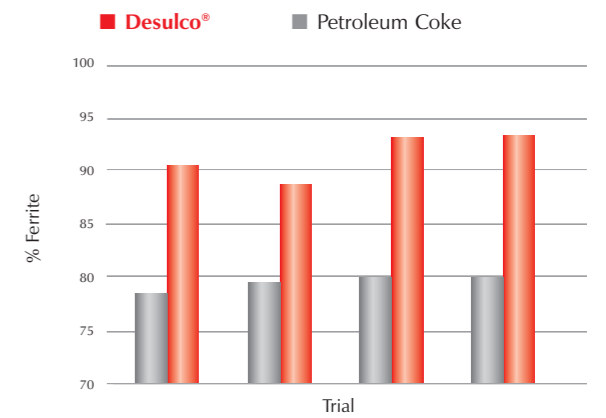
Microstructure

Based on numerous trials and studies performed in different foundries, the microstructure of iron castings is influenced by the type of re-carburiser. In field applications, Desulco® has helped to improve the microstructure of both grey and ductile iron castings. In the case of safety parts for automotive components the following observations were made:



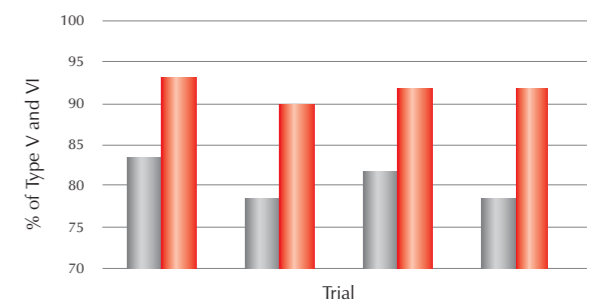
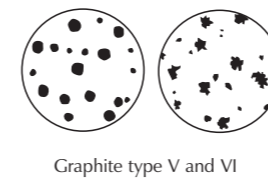
– Ferritic Structure

In the absence of perlite stabilizing elements, Desulco® strongly increased the ferritic matrix of nodular cast iron. The ferrite content of castings using Desulco® was plotted versus the ferrite content of castings made using regular petroleum coke and shows an average improvement of 10 – 15 %



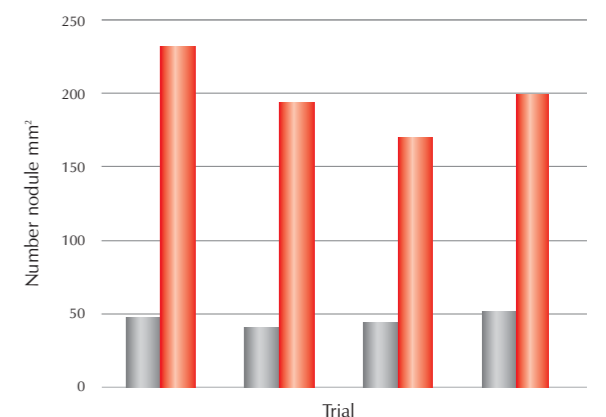
– Nodule Shape Improvement

In the same way, the nodule shape was carefully investigated and the percentage of graphite type V and VI was plotted for Desulco® versus using a coke-based re-carburiser, showing an average improvement of 10 – 15 %



– Nodule Count Improvement

Not only the nodule shape was enhanced, but also a substantial increase of the nodule count, up to 400 % was observed, proving that Desulco® is an effective inoculant. Desulco® can strongly contribute to cost savings by reducing the quantity of expensive post inoculants.



Desulco® in High Grade Steel Applications

In steel production, Desulco® is typically used in high grade steel such as high carbon steels (0,5 % – 0,8 % °C), steel cord (wire mesh for tires), heavy plate, rail, bearing steel, special billet qualities and trim additions to conventional carbon steel.

Desulco® perfectly meets the requirements for high grade steel

- Desulco® ensures **rapid in specification carburation** rates which avoid reprocessing of the steel and minimizes slag foaming.
- Due to Desulco®'s exceedingly **low concentration of volatiles and moisture**, which contribute to hydrogen and nitrogen contamination in the steel, gas related defects of the steel are reduced or eliminated.
- Since Desulco® is virtually **free of sulfur**, the number of calcium sulfide inclusions in the steel can be reduced.



Mission Statement

*We create value for our customers by providing Superior Solutions
– utilizing our unique technologies, processes and talents –
while contributing to the company's long-term success.*

For a complete list of current agents and distributors as well as all the latest news about products and services from Superior Graphite, please visit our website at:
www.superiorgraphite.com

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