

METALLURGY PROCESS OPTIMIZATION

# Case Study

## Controlling chunky graphite in heavy section iron with late inoculation

ASK Chemicals works with Glidewell Specialties Foundry Foundry Company to optimize their metallurgical process.



## >> Background

**Glidewell Specialties Foundry Company was founded in 1963 by Aaron Glidewell. The original foundry was located in Birmingham, Alabama to service the steel mills and railroad wheel manufactures in the Birmingham area. In 1985 Glidewell Foundry merged with Southern Foundry and moved to its current location in Calera, Alabama.**

Glidewell has earned a reputation as a quality supplier of castings to the pump and valve industry. Through continued diversification Glidewell now serves most of the industries that use heavy industrial castings.

Glidewell's mature quality system, sound foundry practices, and attention to detail help ensure that they pour quality castings on a consistent basis. Tools like solidification modeling, Leco analysis, spectrometer analysis, and image analysis help ensure they will have a sound casting at shake-out. However, employing these systems, practices, and tools doesn't guarantee a perfect casting 100% of the time.

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## >> The Issue

**The casting in question is a ductile iron torque arm for the wind energy industry. The pour weight for this casting is 7,800 pounds Ductile iron for the wind energy industry (EN-GJS-400-18U-LT) must meet demanding mechanical properties as well as impact properties of 9 Joules at -20 C. In addition to the required mechanical properties there is some significant non-destructive testing required.**

Following shake-out, shot blasting, and riser removal the inspection department noticed “dark spots” under a riser contact. Glidewell performed an “On Casting” microstructure evaluation of the “dark Spots” and confirmed chunky graphite formation. This riser was designed to feed the heaviest section of this casting. Glidewell used an 8” neckdown riser to feed this heavy section.

## >> The Process

**Melting takes place in two (2) 6-ton coreless induction furnaces. The charge makeup for this casting was 60% Sorel pig iron and 40% steel scrap. The high percentage of pig iron was chosen to help keep tramp elements low. Target tap temperature for this casting is 2650 F.**

The cored wire process is used for the magnesium treatment. A cored wire with 30% magnesium and no rare earths is used at Glidewell Specialties Foundry.

In-mold inoculation with a solid cast insert is the only inoculation used for this casting. A 5 kg insert is rammed up in the pouring basin. The inoculation addition rate for this casting was 0.14%. Minimum pour temperature for this casting is 2450 F.



## >> Solutions

**It was recommended that Glidewell try a solid cast insert containing bismuth and cerium in conjunction with their current in-mold inoculant.**

The molding department rammed up two (2) 5 kg inserts in the pouring basin. One (1) insert had a balanced addition of bismuth and cerium, and the second insert was the standard ductile iron solid cast insert. The inoculation rate for this casting was 0.28%.

With the exception of the solid cast insert containing bismuth and cerium the process remained the same. An “On Casting” microstructure was taken from the second casting, in the same location (under the riser contact). This microstructure evaluation showed no chunky graphite in this area. is the “On Casting” microstructure from the casting with the two (2) 5 kg inserts.

### Examining the microstructure of chunky graphite

“ An acceptable ductile iron microstructure will contain circular, or spherical, graphite nodules. The difference with chunky graphite is that the graphite structure will appear like flakes, thereby ruining the integrity of the metal. ”

## >> Results

After completing all phases of the project ASK Chemicals was able to identify several necessary steps that would assist the customer with enhancing their process and efficiency:

- When combined in controlled levels, cerium and bismuth can increase the process window for chunky-free ductile iron castings.
- Solid cast inserts with controlled amounts of bismuth and cerium have provided the foundryman with a simple method for late inoculation with these elements.
- Preliminary field trials have suggested that this new technology is effective in controlling chunky graphite in the thermal centers of heavy section ductile iron castings.
- Additional trials are scheduled at Glidewell Specialties Foundry Company.
- Field trials at additional foundries should be scheduled to confirm the effectiveness of this new technology in varying foundry conditions.

# >> About ASK CHEMICALS

**ASK Chemicals is one of the largest suppliers of complete solutions and tailor-made consultation services for the foundry industry. The core of our company's activity involves manufacturing all foundry consumables required for the production chain as well as providing optimum technical services in order to perfectly adapt our products to the processes on the customer's premises.**

Our wide product range contains binders for all core manufacturing processes, coatings, additives, feeders, filters, release agents, metallurgical products including inoculants, Mg treatment wires, inoculation wires and pre-alloys for iron casting. Core production and prototype development as well as a wide range of simulation services round off what the company has to offer.



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