SPHEROIDIZERS

There is quite a variety of casting technologies as well as that of physical, mechanical and performance properties castings are expected to conform to. Worldwide production of high-quality ductile iron castings (as well as other high-quality castings) has shown that there is no single all-purpose modifier making it possible for them to conform to these properties. This is the reason why our company produces a wide variety of analytical grades of modifiers. This enables foundry experts to select application-specific modifiers with the required composition and concentration of active components that makes it possible to produce castings possessing the requisite properties under specific casting conditions.

Spheromag®, Spheromax®, SIMAG® and **VERMILOY®** multicomponent spheroidizers with microcrystalline structure (MKMs) produced by our company contain various concentrations of magnesium, calcium, barium and REM. Using a variety of spheroidization methods and techniques makes it possible to produce ductile and compacted iron castings on a consistent basis.

The cooling rates (700-1,000°C/sec.) of liquid MKMs are higher than those of liquid ispheroidizers cast into molds where they crystallize and solidify. As a result, their phases are 5-10 times smaller.

The high cooling rates also promote compacted, highly dispersed structure of the MKMs (chips) and uniform distribution of phases within them.

Liquid iron in ladles is treated by MKMs more uniformly. For example, microcrystalline spheroidizing modifiers, or spheroidizers, have small magnesium-containing phases (10-20 m). As a result, the magnesium vapor bubbles are also small, and subsequently, the surface and time of its contact with the liquid iron are maximally optimum. This factor increases its residual content in the iron.

Liquid MKMs have fine grains and their density increases as they crystallize. Rapid crystallization promotes more homogeneous phase composition and more uniform distribution of the active components of the MKMs such as AEM and REM. Besides, AEM and REM do not accumulate locally and MKMs do not disintegrate with time, which is typical of magnesium-containing spheroidizers in ingot form.

! Take the temperature of molten metal into consideration when treating it with Mg. High temperatures result in a low degree of magnesium recovery.

SPHEROMAG® AND SPHEROMAX® SPHEROIDIZERS

These spheroidizing modifiers are used for treating iron in ladles and molds.

1. SPHEROMAG®611, 711, 621, 721, 631, 731 spheroidizers are predominantly used to treat iron in the ladle when producing castings having pearlite and pearlite-ferrite structures by means of the sandwich process. These castings are in high demand by the machine-building industry where they are used in critical assemblies

The choice of spheroidizers and their consumption depends on the quality of molten metal, viz: the content in it of such detrimental impurities as sulfur and phosphorus as well as carbide-forming and deglobularizing impurities such as chromium, vanadium, titanium, etc., the saturation of the molten metal with dissolved gases such as oxygen, nitrogen and hydrogen. The more impurities the molten metal contains, the more active components the spheroidizer in question should contain. In fact, the numerical grade designations of spheroidizers indicate the average percentage contents of magnesium, calcium and REM.

When selecting the grade, it is also necessary to consider the temperature of the molten metal when it is poured from the furnace into a treatment ladle. The higher the temperature, the higher percentage content of calcium should be. Calcium significantly reduces losses of magnesium as it combines with the latter to form an intermetalide whose dissociation temperature is higher than that of magnesium silicide. Calcium contained in spheroidizers not only reduces magnesium losses caused by flare but also reacts with some of the oxygen and sulfur contained in the molten metal, and as a result they exit the melt as slag.

All spheroidizer grades contain REM whose content does not exceed 1%. They slow down the growth rate of globules, which makes the microstructure of the melt more refined. They also promote binding of non-metallic inclusions thus forming additional graphite crystallization centers, and the strength properties of resultant castings significantly improve.

Spheromag®611, sizes 1-6 mm

2. SPHEROMAG5212, 7103, 7223, 6509 and **6529 spheroidizers** have been developed by our company to treat molten metal to produce ductile iron castings. Ductile iron has a ferrite matrix. Such castings are used to manufacture large-sized items subjected to heavy mechanical loads while in operation. These grades contain barium so the grade designations have four digits. Barium encourages formation of graphite crystallization centers and discourages formation of cementite.

The optimum combination of such chemically active elements as magnesium, calcium, barium, cerium and lanthanum favors formation of a ferrite structure with a high degree of graphite spheroidization (up to 98%) and a large amount of graphite globules (up to 200 pieces per 1 mm2 of the microsection area). These globules are small (20-300 m), which contributes to the ductility and strength of the castings.

3. SPHEROMAG500, 600 and **700 spheroidizers** are used **for in-mold treatment of molten metal to subsequently produce spheroidal graphite iron castings.**

These spheroidizers make it possible to obtain consistent results at their minimum consumption rates (0.7-1.0% of the total weight of the melt) as compared to other melt treatment methods. They are used to produce spheroidal graphite cast irons with predominantly ferrite and pearlite-ferrite matrices (GGG40, GGG45, GGG50). Besides, **SPHEROMAG®500, 600 and 700** spheroidizers contain lanthanum, and when they are used for in-mold treatment of cast iron melts, the degree of undercooling of the molten metal as it crystallizes is higher than when it is treated by an ordinary spheroidizer, FeSiMg5-7. **SPHEROMAG®500, 600 and 700 spheroidizers also favor formation of graphite globules with regular geometric shapes and reduce the likelihood of formation of gas- and shrinkage-related porosity defects in castings.**

The sizes of spheroidizers used for the in-mold treatment process vary within a narrow range (0.8-4.0; 1.0-4.0; 1.0-5.0 and 0.5-3.0 mm) and depend on the types of casting equipment used by customers. Our company also produces these spheroidizer grades in ingot form with its subsequent crushing and sizing.

4. Spheromax923, Spheromax9104, Spheromax915 spheroidizers are used to treat melts in covered ladles to produce spheroidal graphite cast irons having a pearlitic matrix (GGG60 and GGG70) from which castings are made. These cast irons have low silicon contents and high magnesium and barium contents. This combination makes it possible to obtain consistent globular graphite form over the entire cross section of castings. Barium also promotes formation of additional crystallization centers. When treating melts in covered ladles by means of the sandwich process, magnesium is recovered to the greatest possible degree and the spheroidizing effect lasts as long as necessary.

All **Spheromax®** spheroidizers can dissociate in irons at low temperatures, which makes it possible to modify cupola irons with sulfur content up to 0.12% without prior desulfuration and to produce spheroidal graphite cast irons having a pearlitic matrix and spheroidal graphite cast irons having ferritic and pearlitic matrices from which castings are made.