

Magnesium Treatment & their Recovery in SG Iron

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The magnesium treatment is given to the molten metal once it attains the required base chemical composition to meet the required grade of ductile iron. Residual magnesium and magnesium recovery have always been subjects for discussion amongst foundry people.

The most important factors that will influence the recovery of magnesium in ductile iron production are:-

Sulphur Content in Base Iron

Sulphur has to be neutralised in order to increase the surface tension of the iron. High sulphur in the base metal means increased Mg addition.

Oxygen Content in Base Iron

Oxygen has to be neutralised in order to increase the surface tension of the melt. As with sulphur, increased oxygen content requires higher Mg addition.

Slag from the Melting or Holding Furnace

Slag that is transferred from the furnace will react with magnesium and reduce the recovery. Proper separation procedures to minimise slag carry over have to be in place.

Tapping Temperature

Tapping (treatment) temperature should be kept as low as possible in order to avoid excessive reaction violence. The higher the temperature, the more vaporization and lower recovery of magnesium.

Time between Mg/Fe/Si Addition to the Ladle and Tapping

Time between magnesium addition and tapping should be minimised to prevent preheating and oxidation of the alloy. At the same time, there should be no liquid metal residual from previous treatments in the ladle as this may start to react with the alloy.

Slag in Ladle and Pocket

Slag building up in the ladle and reaction pocket leads to reduced magnesium recovery, probably due to reactions between the slag and the magnesium and also as the pocket



depth is reduced changing the reaction conditions. Overspill of alloy will occur if the pocket is allowed to fill with slag. Ladles should be kept tilted or flipped when empty to avoid slag clogging the pockets.

FSM Alloy Cover

An alloy cover in the ladle, for example fine sized Fe/Si or steel plates, will delay the reaction start and give better absorption of magnesium into the liquid metal.

Filling Time

Metal filling rate should be high in order to achieve a high ferrostatic head in the ladle before the reaction starts.

Fading / Pouring Time

Long holding times after treatment and long pouring times require higher initial Mg contents to compensate for fading effects. Pouring times should be minimised to

overcome these effects. See TI sheet No. 26 for more information.

Inoculation

With a good inoculation, less residual magnesium is required to give good nodularity. This again means less alloy addition and better magnesium recovery.

Ladle Design

The internal Height: Diameter ratio should be at least 2:1 and the FSM pocket should have space enough to carry the alloy addition and covering material. A tundish cover lid is also highly recommended for alloy and temperature recovery reasons.

Chemical Composition of Nodulariser

High magnesium content in the alloy will give a violent reaction and reduced recovery. High Ca will reduce the reactivity and increase the recovery, but also increase the tendency to slag formation.

Alloy Sizing

A wide alloy sizing gives dense bulk packing in the pocket. The alloy will then fuse and react (dissolve) slowly in a controlled manner with a minimum of pieces floating. Lumps floating and burning on the surface are a waste.

Storage of Foundry Alloys

All foundry alloys will oxidise if exposed to moisture. Oxidised alloys will give a lower recovery than fresh materials. Containers of alloy should be stored in a dry place and not opened until required at the treatment station

Inoculation : The Most Important Part Of SG Iron Production

Proper inoculation of graphitic cast irons cannot be over emphasized, because this step defines the final microstructure and resultant properties and minimizes problems. Inoculation, if done correctly, controls the nodule count, reduces or eliminates carbides, produces the correct mechanical properties, improves machinability, and will decrease shrinkage. The addition of inoculants has to be done as per calculation without any fail.

Do not over inoculate. It may increase shrinkage.