Foundry Alloys

QS-9000 ISO 9001 ISO 14001

LAMET™ Nodulariser

Elkem

www.foundry.elkem.com

LAMET™ Nodulariser

A nodulariser for production of ductile iron by in-the-mould methods.

- Excellent casting consistency
- High nodule count
- Low shrinkage tendency
- High magnesium yield
- Cost effective

Elkem Lamet™ nodulariser is designed specifically for in-the- mould production of ductile cast iron. Lamet nodulariser is a cost effective and consistent means of treating ductile iron and produces good nodule structures. There is a low shrinkage tendency when compared to conventional MgFeSi alloys used in this process. Lamet nodulariser is produced at Elkem's Bjølvefossen plant on the west coast of Norway. The plant specialises in the production of MgFeSi based alloys and is certified to ISO 9001, ISO 14001 and QS9000 standards. This emphasis on quality ensures that Lamet nodulariser is made with a uniform chemistry and grain size thus giving consistency in performance. The use of special production routes ensures that the product is very low in residual oxide contents and tramp elements which may be harmful to ductile iron production. The production method also incorporates a rapid cooling technique which gives a minimum of chemical segregation during solidification. Thus the resultant alloy is homogenous with a low fines content and uniformly distributed active elements.

Lamet nodulariser is produced to the following specifications:

Silicon:	44 - 48%
Magnesium:	5.0 - 6.0%
Lanthanum*	0.25 - 0.40%
Calcium:	0.4 - 0.6%
Aluminium:	0.8 - 1.2%

**** Note that the rare earth content in Lamet is as pure Lanthanum.***

Use of in-the-mould processes

The principle of adding magnesium ferrosilicon to a reaction chamber inside the mould cavity has been known for many years.

Some of the advantages of such a process are:

- Reduced number of production steps
- No holding of treated iron
- Reduced slag problems in holding furnaces
- No treatment fading
- Late treatment discourages undercooling and carbide formation
- Minimal enviromental impact

Conversely, there are some disadvantages to the process. Some of these are:

- Reduced space on the pattern plate
- Reduced casting yield
- Potential generation of dross in the mould
- Late treatment may give higher demands of post casting inspection

Use of Lamet nodulariser

Conventional MgFeSi alloys when used as in-the-mould nodularising agents can have several disadvantages. Promotion of shrinkage porosity and generation of inclusion defects are known problems.

Use of Lamet nodulariser, which is very low in slag promoting elements, is an effective way of making clean ductile iron castings. By using pure lanthanum in the alloy in place of the traditional rare earth mixture of elements*, Lamet nodulariser promotes a lower shrinkage tendency as demonstrated in the case studies.

Lamet nodulariser standard sizing is 1 - 4 mm with maximum 10 % over-and undersize as specified limitations.

Use of Lamet nodulariser is best illustrated by the use of case studies taken from Elkem's worldwide customer base.

Case study 1:

A foundry had problems with massive shrinkage in a hot spot in one of their castings. Castings were picked out, cut in the same position and examined. One of the samples was produced using mischmetal containing MgFeSi while one was produced using Lamet nodulariser. Photomicrographs of the examined samples are shown in figure 1.

In this case, it was shown that:

The Lamet nodulariser alloy gave significantly higher nodule count than the mischmetal based material. About 280 nodules/mm^2 were obtained with Lamet nodulariser while only about 170 nodules/mm^2 were found with the mischmetal based alloy. This is an increase of 65% with the Lamet nodulariser.
Nodularity was 5 % higher for the castings produced with Lamet nodulariser than for the castings produced with the mischmetal containing alloy.
The use of the Lamet nodulariser eliminated shrinkage porosity. The mischmetal containing alloy caused massive shrinkage in a hot-spot section, and Lamet nodulariser was found to completely eliminate these shrinkage voids.
The formation of a bimodal or skewed nodule size distribution with small and late precipitated nodules was found. This is likely to be the reason for the effective shrinkage control with the Lamet nodulariser

Case study 2:

The foundry discovered that they got a significant reduction in shrinkage porosity while using Lamet nodulariser compared to their regular in-the-mould MgFeSi. To show this, castings produced using Lamet nodulariser and castings produced using their regular MgFeSi were examined. Results are given as Figure 2.

The following conclusions were drawn from the examination:

Lamet nodulariser was found to give about 20% higher nodule count than the regular MgFeSi alloy. An average of 337 nodules per mm^2 was found with Lamet nodulariser versus 279 nodules per mm^2 with the regular alloy. The effect is most pronounced for the thicker sections, where Lamet nodulariser gave about 30% more nodules than the regular alloy.
The Lamet nodulariser samples show a clear dual population of nodules with some big nodules and several small nodules. This effect is not found in the samples produced with the regular mischmetal based alloy.
Shrinkage tendency was found to be significantly less with Lamet nodulariser as compared to the regular MgFeSi alloy.

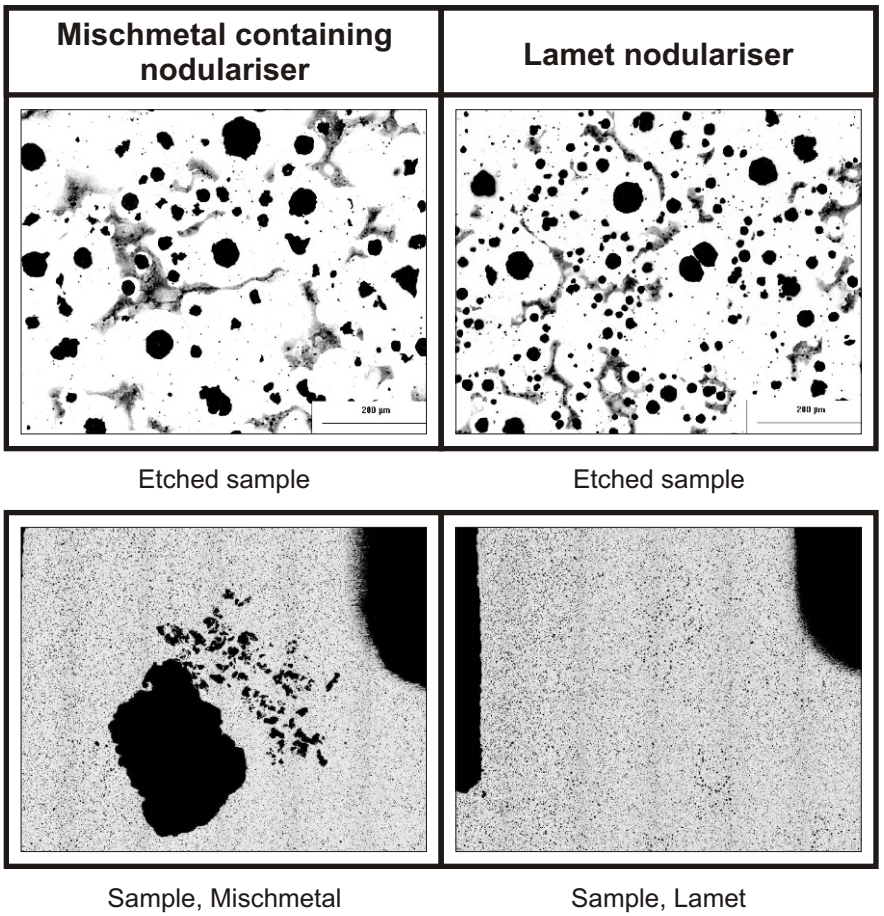

Figure 1: Microstructure and results from examination of samples produced with mischmetal containing MgFeSi and Lamet nodulariser. The shrinkage porosity with mischmetal based MgFeSi is completely eliminated using Lamet nodulariser.

**Traditional rare earth mixture is mischmetal containing approximately 50%Ce, 25%La, 15%Nd and 10%Pr.*

Case study 3:

A foundry producing crankshafts observed a significantly better surface finish on bearing journals when using Lamet nodulariser versus their normal nodulariser. The reason for the better surface finish is believed to be the smaller nodule sizes giving less graphite pull-out during machining.

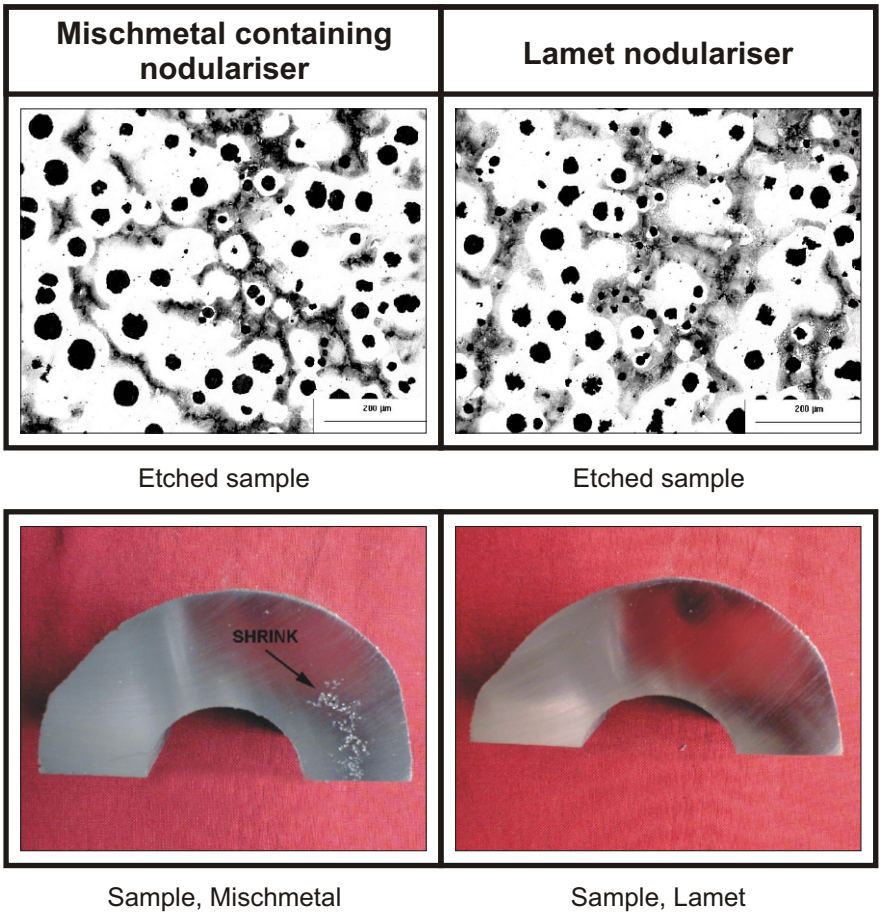

Figure 2: *Microstructure and results from examination of samples produced with mischmetal containing nodulariser and Lamet nodulariser. The shrinkage tendency is significant less in castings produced using Lamet compared to the regular mischmetal containing MgFeSi.*

Summary of the case studies

Nodule counts are found to be significantly higher for castings produced using Lamet nodulariser compared with castings produced using mischmetal containing alloys. The difference is most pronounced at increased section thicknesses.

In most cases it is found that nodularity is better with Lamet. As with the nodule count, the differences are most pronounced at increased section thickness.

One characteristic found in all the case studies is the formation of a bimodal or skewed nodule size distribution. That is, a high number of very small nodules and only a few large nodules. It has been found that the small nodules in this bimodal distribution often will occur from a secondary, late precipitation event in the last part of the solidification sequence. Such late precipitation and growth of nodules gives a graphite expansion that effectively counteracts shrinkage during the last part of the solidification. This is when feeders and have stopped functioning and when the graphite expansion is most needed to counteract shrinkage.

The higher nodule count has in some cases shown to improve the surface finish of machined castings.

Elkem

Elkem ASA
Foundry Products Division
Hoffsveien 65B
P.O. Box 5211
Majorstua
N-0303, Oslo, Norway

Telephone : +47 22 45 01 00
Telefax : +47 22 45 01 52

Изключителен представител и вносител за България и Македония:

"РЕМЕКО" ООД

1407 София, бул. "Дж. Баучър", 99-101
тел.: +359 2 962 20 78, 962 47 36
факс: +359 2 962 21 02
e-mail: remeko@remeko.com

Printed in England. Ref: Revised November 2001