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3,375,104
METHOD OF PRODUCING MAGNESIUM
FERROSILICON

Melvin L. McClellan, Grand Island, N.Y., assignor to
Union Carbide Corporation, a corporation of New
York
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ABSTRACT OF THE DISCLOSURE

Method of producing magnesium-containing ferrosilicon
without excessive loss of magnesium by adding magnesi-
um to molten ferrosilicon containing more than 53%
silicon and then diluting the ferrosilicon with iron to ob-
tain the desired ferrosilicon composition.

The present invention relates to the production of mag-
nesium ferrosilicon. More particularly the present inven-
tion relates to a method of adding magnesium to ferro-
silicon alloys whereby substantially improved recoveries
of magnesium are obtained.

A common technique for producing magnesium-con-
taining ferrosilicon is to provide a bath of molten ferro-
silicon alloy in a ladle and adding magnesium by plunging
magnesium ingots into the molten metal. Other techniques
are also used, but the problem of magnesium recovery is
common to all in view of the relatively low boiling point
of magnesium (2030° F.) with respect to molten ferro-
alloy (2250-2400° F.).

This problem of magnesium recovery is highly signifi-
cant in view of the cost of the metal and also creates
a safety hazard in that the portion of magnesium which
is not dissolved in the alloy is subject to flaring.

It is therefore an object of the present invention to pro-
vide a process for adding magnesium to ferrosilicon alloys
whereby a very high proportion of the magnesium is re-
covered in the alloy.

Other objects will be apparent from the following de-
scription and claims.

A process in accordance with the present invention com-
prises providing a molten bath of ferrosilicon containing
at least 53 percent silicon; adding magnesium to the mol-
ten ferrosilicon by dissolving magnesium metal therein;
and, after dissolution of magnesium, adding iron to the
molten bath to increase the iron content of the magne-
sium-containing ferroalloy to the desired value.

The present invention is particularly directed to the
production of magnesium-containing ferrosilicon having a
silicon content of about 44-50%; an iron content of about
40 to 45% and a magnesium content of 5 to 15%.

bath is at least 53% prior to the magnesium addition, with
iron being subsequently added to adjust the final alloy
composition to its desired value, magnesium recoveries
can be increased to 80% and higher. The reason for this
is believed to be that the higher silicon content in the
starting ferrosilicon provides silicon available for the for-
mation of Mg_2Si , upon the addition of magnesium, where-
by the vapor pressure of magnesium is lowered and losses
reduced.

The following example will illustrate the method of
the present invention.

Example 1

Molten ferrosilicon alloy (56% Si, about 2% incidental
impurities, balance iron) in the amount of 5000 pounds
is provided in a ladle at a temperature of about 1400° C.
At this temperature magnesium metal in the amount of
650 pounds is plunged into the ferrosilicon by attaching
magnesium ingots to steel bars and holding the ingots
beneath the surface of the steel bath until the magnesium
ingots are dissolved. The temperature after the plunge is
about 1290° C.

Steel scrap, in the form of cut up bars (1" or more in
diameter and about 4" or more in length) weighing 593
pounds is added to increase the iron content, causing prac-
tically no temperature change. The alloy is then cast and
analyzes about 9% Mg, 46% Si, 44% iron. The mag-
nesium recovery is 85%.

To further illustrate the present invention, tests were
conducted by making heats as shown in Table I.

Heat 1 was made in the conventional manner by plung-
ing magnesium directly into ferrosilicon having the de-
sired final silicon to iron ratio. Heat 2 was made by using
a higher silicon ferrosilicon as the starting alloy and, after
the magnesium addition, adding iron, to obtain a product
of the desired composition.

In obtaining the data of Table I the heats were pre-
pared by melting the charge in an Ajax induction furnace
using a graphite crucible. For plunging the magnesium, a
magnesium ingot was attached to steel bars and submerged
in the melt so that the ingot was 2 or 3 inches beneath
the surface and held in this position until they were dis-
solved.

The iron addition for heat 2 was in the form of scrap
steel bars 1" in diameter by 4" long.

TABLE I

Heat No.	Furnace Charge, lbs.		Mg Addi- tion, lbs.	Iron Addi- tion, lbs.
	50% FeSi	Si Metal		
1.....	174	8	22.95	-----
2.....	145	23	22.90	15

TABLE IA

Heat No.	Cup Sample After Meltdown, percent			Temp., ° F.	Final Alloy Sample, percent			Recoveries, percent	
	Si	Fe	Mg		Mg	Fe	Si	Mg	Si
1.....	50.18	47.53	0.12	2,450	10.29	42.0	45.67	77.6	86.2
2.....	53.51	41.66	0.67	2,490	10.29	42.89	44.68	84.8	90.2

In the past, the usual manner of preparing such an al-
loy, which is widely used in the manufacture of ductile
iron, was to provide a bath containing 50% ferrosilicon
(containing 44 to 50% Si) and adding magnesium metal,
usually by plunging, to provide the desired magnesium
content. Magnesium recoveries following this practice
were usually on the order of 65%.

It has been discovered however, as part of the present
invention, that if the silicon content of the ferrosilicon

As can be seen from the foregoing table, in making a
magnesium-containing ferrosilicon wherein the iron and
silicon contents are substantially in a 1 to 1 ratio, con-
siderably higher magnesium recovery is obtained using
the practice of the present invention.

In the practice of the present invention it is important
to use heavy steel scrap, e.g., in the form of cut-up bars
about 1" diameter by 1" long or larger, for the iron ad-
dition so that the scrap sinks immediately to the bottom.

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Light scrap, such as punchings and turnings, is not suitable since this type of material tends to remain at the surface and leads to boiling and loss of magnesium.

What is claimed is:

1. A process for adding magnesium to ferrosilicon to produce an alloy containing substantially equal amounts of iron and silicon and from about 5 to about 15 percent magnesium whereby high recoveries of magnesium are obtained, said process comprising:

- (1) providing a molten bath of ferrosilicon containing at least 53 percent silicon
- (2) plunging magnesium metal below the surface of the molten ferrosilicon to cause magnesium to be dissolved therein

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- (3) and, after dissolution of the magnesium, adding iron to the molten bath in a form that sinks beneath the surface of the iron bath to provide, upon dissolution of the added iron, an alloy containing substantially equal amounts of iron and silicon.

References Cited

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