ORIGINAL

METHOD FOR PRODUCING LOW CARBON SILICO MANGANESE

ABSTRACT

The invention provides a method for producing low carbon silico manganese. The method includes producing the low carbon silico manganese in an induction furnace. Additionally, the method includes separating carbon from silico manganese to obtain low carbon silico manganese.

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CLAIMS

We claim:

1. A method of producing low carbon silico manganese, the method comprising:

heating a mixture of ferro silicon and high carbon silico manganese in an induction furnace for obtaining a molten alloy;

maintaining molten state of the molten alloy using a flux for a predefined time duration for obtaining a uniform molten alloy; and

tapping out low carbon silico manganese upon removing carbon scum from the uniform molten alloy.

2. The method of claim 1, wherein the heating of the mixture of the ferro silicon and the high carbon silico manganese comprises maintaining temperature in the induction furnace at 1350 degree Celsius.

3. The method of claim 1, wherein the mixture of the ferro silicon and high carbon silico manganese comprises the ferro silicon in a weight ratio of 1:3 to the high carbon silico manganese.

4. The method of claim 1, wherein the flux comprises at least one of at least one of a lime, a fluorspar and a slag binder.

5. The method of claim 1, wherein the predefined time duration for obtaining a uniform molten alloy comprises the predefined time duration for a period of one hour and fifteen minutes.

6. The method of claim 1, wherein the uniform molten alloy comprises at least 27% of silicon content.

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COMPLETE SPECIFICATION

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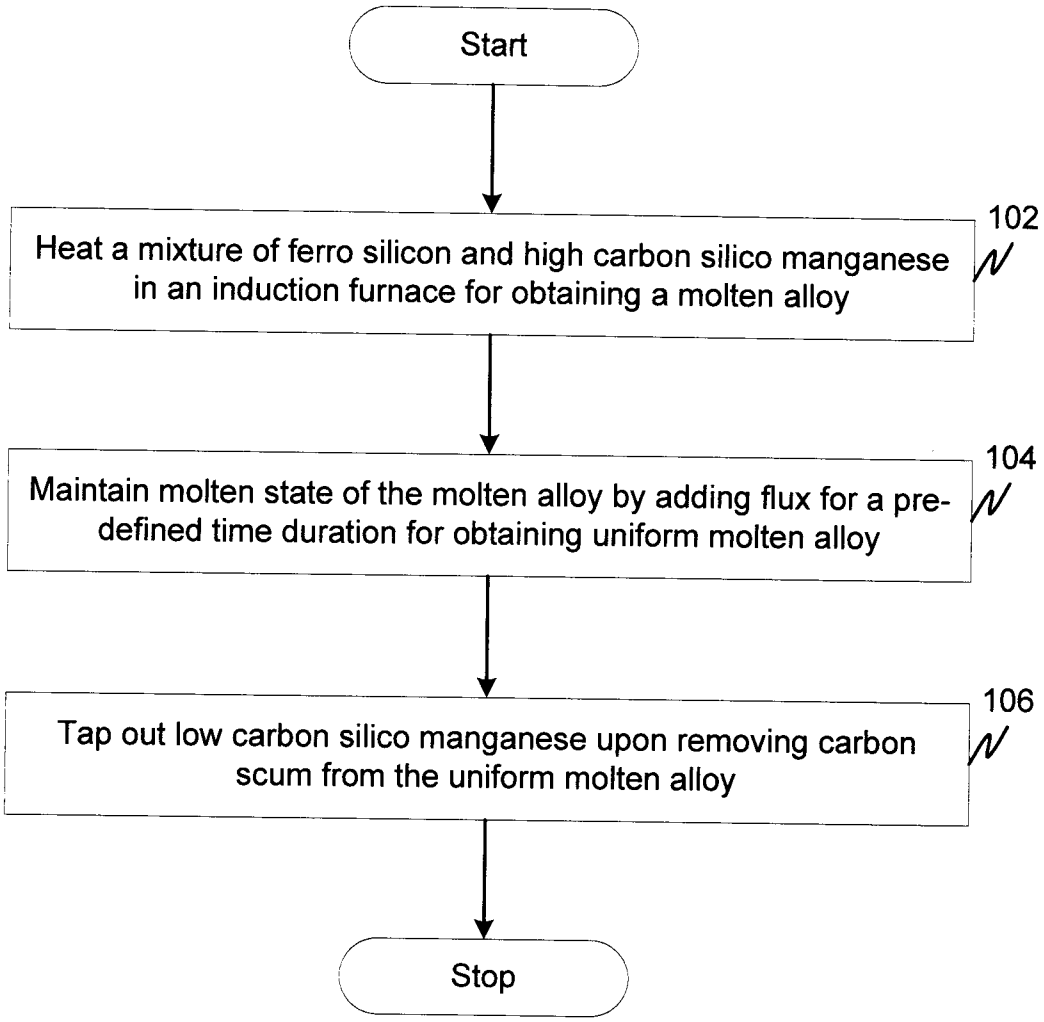

Fig. 1

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METHOD FOR PRODUCING LOW CARBON SILICO MANGANESE

FIELD OF THE INVENTION

[0001] The invention generally relates to producing low carbon silico manganese and more specifically, to a method for producing low carbon silico manganese using an induction furnace.

BACKGROUND OF THE INVENTION

[0002] Silico manganese (SiMn) is a ferro-alloy with high contents of manganese and silicon. Typically, SiMn is produced by heating a mixture of the manganese oxide (MnO2), silicon dioxide (SiO2), and iron oxide (Fe2O3), with carbon in a furnace. Standard grade silico manganese contains 14 to 16% of silicon, 65 to 68% of manganese and 2% of carbon. However, low carbon silico manganese has carbon levels from 0.05 to 0.10%.

[0003] SiMn is generally produced by smelting of manganese ore with high silica content in submerged arc furnaces. The submerged arc furnaces require more power to produce silico manganese on account of high silicon content. Thus, current methods of silico manganese production involve high operating costs and thereafter results in high cost of the finished product.

[0004] Therefore, there is a need for an economical method and system for for production of low carbon silico manganese.

BRIEF DESCRIPTION OF THE FIGURES

[0005] The accompanying figures where like reference numerals refer to identical or functionally similar elements throughout the separate views and which together with the detailed description below are incorporated in and form part of the specification, serve to

further illustrate various embodiments and to explain various principles and advantages all in accordance with the invention.

[0006] FIG. 1 illustrates a flow diagram of a method of producing low carbon silico manganese.

[0007] Skilled artisans will appreciate that elements in the figures are illustrated for simplicity and clarity and have not necessarily been drawn to scale. For example, the dimensions of some of the elements in the figures may be exaggerated relative to other elements to help to improve understanding of embodiments of the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0008] Before describing in detail embodiments that are in accordance with the invention, it should be observed that the embodiments reside primarily in combinations of method steps and apparatus components related to method and system for producing low carbon silico manganese using an induction furnace.. Accordingly, the method steps have been represented where appropriate by conventional symbols in the drawings, showing only those specific details that are pertinent to understanding the embodiments of the present invention so as not to obscure the disclosure with details that will be readily apparent to those of ordinary skill in the art having the benefit of the description herein.

[0009] In this document, relational terms such as first and second, top and bottom, and the like may be used solely to distinguish one entity or action from another entity or action without necessarily requiring or implying any actual such relationship or order between such entities or actions. The terms "comprises," "comprising," or any other variation thereof, are intended to cover a non-exclusive inclusion, such that a process, method, article, or apparatus that comprises a list of elements does not include only those elements but may include other elements not expressly listed or inherent to such process, method, or apparatus. An element proceeded by "comprises ...a" does not, without more

constraints, preclude the existence of additional identical elements in the process, method, or apparatus that comprises the element.

[0010] Various embodiments of the invention provide a method and system for production of low carbon silico manganese using an induction furnace. Initially, a mixture of pre-calculated silico manganese and ferro silicon is added to an induction furnace. Thereafter, the mixture in the induction furnace is heated till the mixture forms a molten alloy. In order to maintain the molten state of the mixture, flux is added to the mixture which maintains the molten state of the molten alloy for a period of one and half hours. As a result, a homogeneous mixture of the molten alloy is produced resulting in a uniform molten alloy. Subsequently, once silicon content in the uniform molten alloy becomes 27%, carbon gets separated from the uniform molten alloy and forms as a scum over the uniform molten alloy. This carbon is then removed from the uniform molten alloy to obtain low carbon silico manganese.

[0011] FIG. 1 illustrates a flow diagram of a method of producing low carbon silico manganese in accordance with an embodiment.
At step 102, a mixture of ferro silicon and high carbon silico manganese is heated in an induction furnace. The induction furnace used may be of medium frequency type. The mixture is inductively heated in the induction furnace to a temperature of around 1400 degree Celsius to obtain a molten alloy. The ferro silicon in the mixture is added in a weight ratio of 1:3 to the high carbon silico manganese. This is to ensure that the quantity of silicon is more than 27% of the finished product.

[0012] In an exemplary embodiment, the initial quantity of the ferro silicon and high carbon silico manganese of the mixture is pre-calculated in order to obtain more than 27% of silicon in the finished product. According to the weight ratio of the mixture, 250kgs of ferro silicon is added to 750kgs of high carbon silico manganese to obtain 1 metric ton of low carbon silico manganese. A typical 750kgs of high carbon silico manganese contains 15% of silicon. Hence, the total quantity of silicon content in the high carbon silico manganese is 112.5kgs. Similarly, a typical 250kgs of ferro silicon contains 70% of silicon. Hence, total quantity of silicon in the ferro silicon is 175kgs. The

total quantity of silicon in the mixture is 287.5kgs which is more than 27% of the total quantity of finished product i.e. 1 metric ton of low carbon.

[0013] At step 104, flux is added to the molten alloy to maintain the molten state of the molten alloy. The flux may include, but not limited to, one or more of lime, fluorspar and slag binder. The flux forms a thick film over the surface of the molten alloy. The thick film prevents the molten alloy to come in contact with the atmosphere which in turn reduces heat loss and oxidation of the molten alloy. Further, the addition of the flux maintains the molten state of the molten alloy for a period of one hour. During this period, the molten state of the molten alloy forms a homogenous mixture. This homogeneous mixture results in a uniform molten alloy.

[0014] Further, silicon content in the uniform molten alloy assists in separating carbon from the uniform molten alloy. Once the silicon content in the uniform molten alloy reaches 27%, the carbon starts floating on the surface of the uniform molten alloy as the density of carbon is lesser than the uniform molten alloy. The carbon forms as a scum on top of the uniform molten alloy. The carbon may then be removed manually from the furnace using a shovel for obtaining low carbon silicon manganese. Accordingly, at step 106, the low carbon silico manganese is tapped off from the induction furnace. The low carbon silico manganese may be tapped out from the furnace by tilting the induction furnace and collecting the low carbon silico manganese in a crucible. Further, the low carbon silico manganese collected in the crucible is allowed to cool at room temperature and is then recovered from the crucible.

[0015] Example:

[0016] Production of Low Carbon Silico Manganese

[0017] To produce 1 metric ton of low carbon silico mangense, a charge comprising a mixture of 750kgs of high carbon silico manganese and 250kgs of ferro silicon was added to a medium frequency type induction furnace. The silicon content in the 750kgs of high carbon silico manganese was 112.5kgs and the silicon content in the 250kgs of ferro silicon was 175kgs. Initially, 10% of the total charge was added to induction furnace and

the furnace was ignited. Thereafter, the charge which was fed to the furnace was heated in the induction furnace to around 1400 degree Celsius for melting the charge in the induction furnace. Once the charge in the induction furnace had attained a semi-molten form, additional charge was added to the furnace. This process was repeated until entire charge was added to the induction furnace. Thereafter, the temperature in the induction furnace was increased to more than 1400 degree Celsius to melt the charge in the induction furnace and form a molten alloy.

[0018] Further, flux was added to the molten alloy to maintain the molten state of the molten alloy. The flux used was slag binder. The flux formed a thick film over the surface of the molten alloy. The thick film prevented the molten alloy to come in contact with the atmosphere which in turn reduces heat loss and oxidation of the molten alloy. Further, the addition of the flux assisted in maintaining the molten state of the molten alloy for a period of one hour. During this period, the molten state of the molten alloy formed a homogenous mixture. This homogeneous mixture resulted in a uniform molten alloy.

[0019] Silicon content in the uniform molten alloy assisted in separating carbon from the uniform molten alloy. Total silicon content in the uniform molten alloy was 287.5kgs. Since the silicon content in the uniform molten was 27% of the total quantity of the uniform molten alloy, the carbon in the uniform molten alloy started floating on the surface of the uniform molten alloy. The carbon formed as a scum on top of the uniform molten alloy. After a period of around 15 minutes, the carbon was removed from the induction furnace using a shovel. Thereafter, the low carbon silico manganese was tapped off from the induction furnace. The low carbon silico manganese was tapped out from the furnace by tilting the induction furnace and collecting the low carbon silico manganese in a crucible. Further, the low carbon silico manganese collected in the crucible was allowed to cool at room temperature and then recovered from the crucible. The low carbon silico manganese that was recovered from the crucible comprised of around 55% of manganese, around 27% of Silicon and 0.1% of carbon.

[0020] Various embodiments of the invention provide method for production of low carbon silico manganese. The method ensures lowering operation costs during the

production of low carbon silico manganese. The method utilizes an induction furnace which consumes less power than conventional furnaces. Hence, cost of the final product is also significantly lowered.

[0021] Those skilled in the art will realize that the above recognized advantages and other advantages described herein are merely exemplary and are not meant to be a complete rendering of all of the advantages of the various embodiments of the present invention.

[0022] In the foregoing specification, specific embodiments of the present invention have been described. However, one of ordinary skill in the art appreciates that various modifications and changes can be made without departing from the scope of the present invention as set forth in the claims below. Accordingly, the specification and figures are to be regarded in an illustrative rather than a restrictive sense, and all such modifications are intended to be included within the scope of the present invention. The benefits, advantages, solutions to problems, and any element(s) that may cause any benefit, advantage, or solution to occur or become more pronounced are not to be construed as a critical, required, or essential features or elements of any or all the claims. The present invention is defined solely by the appended claims including any amendments made during the pendency of this application and all equivalents of those claims as issued.