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Neu

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[54] **DEOXIDISING MOLTEN NON-FERROUS METALS**

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[58] **Field of Search** ..... 75/76, 93, 58, 130 A, 53, 75/73; 117/16

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[57] **ABSTRACT**

Molten non-ferrous metals, particularly copper, are refined by treatment with a porous carbonaceous refractory such as coke impregnated with an alkali metal, alkaline earth metal or magnesium. Sodium and magnesium are the preferred impregnants.

2 Claims, No Drawings

DEOXIDISING MOLTEN NON-FERROUS METALS

FIELD OF THE INVENTION

This invention relates to deoxidising and/or desulphurising molten non-ferrous metals or alloys, particularly molten copper or copper matte.

PRIOR ART

In the manufacture of pure copper from its ores a large number of extractive refining steps are carried out. Some of these stages are expensive and time consuming, and efforts are constantly being directed to making them faster and more efficient.

Thus, in the manufacture of copper, concentrated ore and fluxes are heated together in a reverberatory furnace to convert the ore, usually in the form of sulphides, to copper matte, which is a fusion of copper and iron sulphides. In order to remove from the matte undesired iron and sulphur, the molten matte is introduced into a converter. In the converter air or air enriched with oxygen is blown through the molten matte and the oxygen combines with the iron, and with silica contained in an added flux to produce iron silicate in the form of a removable slag. At this stage the sulphur content of the matte is of the order of 20 percent and the oxygen content is negligible. Further blowing of air or air enriched with oxygen removes the sulphur from the matte in the form of gaseous sulphur oxides. The usual product of the converter, which is known as "blister" copper on account of the appearance of its upper surface if cast, contains oxygen, sulphur and frequently a wide variety of other impurities.

During the course of blowing air through the molten matte contained in the converter the sulphur level of the matte is gradually reduced by oxidation, and the level of retained oxygen is gradually increased. Normally blowing is discontinued when the blister copper stage has been reached, at which stage the sulphur content is usually less than 0.01 percent and the oxygen content less than 1 percent. Although not generally practised blowing may be discontinued at any other stage of the converter process.

Blister copper must be further refined before use irrespective of whether it is to be cast directly into shapes for further working or subjected to a subsequent electrolytic refining operation. This further refining includes further desulphurising by blowing in air or air enriched with oxygen into the molten blister copper and includes subsequently reducing the excess oxygen content. Oxygen is customarily removed by poling - immersing the ends of green hardwood trees into the molten metal bath - and optionally aided by covering the bath with coke or other carbonaceous material. This method is difficult and inconvenient to carry out and is fundamentally inefficient. It is also prodigal of trees.

All these copper smelting and refining operations are expensive in terms of air, power and refractory usage and are time-consuming. They suffer from the disadvantage that the further smelting or refining proceeds, the slower the process becomes, i.e., the efficiency of, for example, sulphur or oxygen removal drops away rapidly. In order to work an economic compromise, therefore, the converter operation is often curtailed with undesirably high oxygen, sulphur or other impurity contents in the molten metal. This leads to longer subsequent treatment times in the next refining or smelting stage.

OBJECTS OF THIS INVENTION

It is accordingly a principal object of the present invention to provide a method of refining non-ferrous metals to remove sulphur and/or oxygen therefrom with greater efficiency than the aforementioned processes.

It is a further specific object of the invention to provide a process for desulphurising copper efficiently and without the drawbacks noted above.

GENERAL DESCRIPTION OF THE INVENTION

I have now found that in copper production and in analogous processes in other non-ferrous metal smelting and refining operations, the metal production processes may be more economic and rapid by the use of additives comprising alkali metals, alkali earth metals or magnesium.

According, therefore, to the present invention there is provided, in a process of smelting or refining a non-ferrous metal or alloy melt, particularly a copper-containing melt, the step of adding to the melt a treatment agent in the form of a body of porous carbonaceous refractory material impregnated with sodium, potassium, calcium or magnesium or an alloy containing at least 20 percent by weight of one or more of these.

According to a further feature of the invention there is provided a process for the refining of copper which comprises blowing air or air enriched with oxygen into molten copper or matte until the residual oxygen content of the molten copper reaches a value of not more than 0.3 percent by weight, and adding to the molten copper a treatment agent in the form of a body of porous carbonaceous refractory material impregnated with sodium, potassium, calcium or magnesium or an alloy containing at least 20 percent by weight of one or more of these.

According to a further feature of the invention there is provided a process for the production of copper which comprises blowing air or air enriched with oxygen into molten copper or matte until the residual sulphur content of the molten copper has been reduced to not more than 1 percent and adding to the molten copper a treatment agent in the form of a body of porous carbonaceous refractory material impregnated with sodium potassium calcium or magnesium, or an alloy containing at least 20 percent of one or more of these.

The preferred porous carbonaceous refractory material is coke and the preferred impregnants are sodium and magnesium.

Treatment agents as just defined are preferably used bu immersing them in the molten metal under treatment, for example, by plunging. Because of the heat in the molten metal, the impregnant metal vaporises and the vapour effects a deoxidising and desulphurising action on the molten metal.

The efficiency of sulphur and/or oxygen removal using treatment agents according to the invention will depend on such factors as molten metal temperature, configuration of the treatment vessel and treatment time may vary from 40 percent to 90 percent.

The use of treatment agent as just defined is of particular value in copper production as noted above. In particular magnesium-impregnated coke may be immersed in the molten metal towards the end of a converter cycle in order rapidly to reduce the remaining sulphur content and to remove excess oxygen, introduced during the conversion. Plunging magnesium impregnated

coke may also reduce or replace poling to deoxidise copper in a refining furnace or other vessel. By the careful use of metal-impregnated treatment agents as defined above, it may even be possible to dispense with one or more separate refining operations at present considered necessary in copper or other non-ferrous metal production. For instance in the copper refining sequence noted above, the purity of copper from the converter may be so raised that anodes for electrolytic refining may be cast directly from the converter without further need for fire refining. By use of a sufficient quantity of treatment agent, the oxygen content of the molten copper can easily be reduced to below 0.05 percent by weight.

Although the process of the invention has been described with reference to the smelting or refining of a copper containing melt, it may also be used in the processing of mattes and matte-like materials containing one or more of the following metals :- nickel, cobalt, zinc, lead, gold, silver and platinum, or in the treatment of metals such as nickel and nickel alloys.

SPECIFIC EXAMPLES

In these examples, all percentages are by weight.

EXAMPLE I

30 kg of cathode copper were melted, under a reducing flux cover, in a crucible in an oil-fired lift out furnace. After melting and at a temperature of 1,200°C the flux cover was removed, and sulphur was added to the molten copper by plunging cuprous sulphide wrapped in pure copper foil into the melt. Suction samples of molten copper were taken from the lower part of the crucible. 90g of magnesium impregnated coke containing 44 percent magnesium were then plunged into the molten copper using a plumbago plunger until reaction was complete. After reaction had taken place the melt was allowed to stand for 5 minutes in order that solid desulphurisation products could rise to the surface of the molten copper. Further suction samples of molten copper were then taken from the lower part of the crucible.

All the metal samples were analysed, and the following results were obtained:

Sulphur content before treatment	—	0.15%
Sulphur content after treatment	—	0.015%

EXAMPLE II

30 kg of cathode copper were melted, under a reducing flux cover, in a crucible in an oil-fired lift out furnace. After melting and at a temperature of 1,200°C the flux cover was removed, and oxygen was added to the molten copper by blowing air into the melt. Suction samples of molten copper were taken from the lower part of the crucible. 350g of magnesium impregnated coke containing 44% magnesium were then plunged into the molten copper using a plumbago plunger until reaction was complete. After reaction had taken place the melt was allowed to stand for 5 minutes in order that solid deoxidation products could rise to the surface of the molten copper. Further suction samples of molten copper were then taken from the lower part of the crucible.

All the metal samples were analysed, and the following results were obtained:

Oxygen content before treatment	—	0.28%
Oxygen content after treatment	—	0.024%

EXAMPLE III

Molten copper from a converter was transferred into a 25 tonne treatment ladle, and was treated at a temperature of 1,230°C with 350kg magnesium impregnated coke containing 44 percent magnesium. The treatment time was 20 minutes.

The copper was analysed for sulphur and oxygen before and after treatment and the following results were obtained:

Oxygen content before treatment	—	0.31%
Oxygen content after treatment	—	0.02%
Sulphur content before treatment	—	0.06%
Sulphur content after treatment	—	less than 0.01%

I claim as my invention

1. In the refining of copper wherein air optionally enriched with oxygen is blown into molten copper or matte, the improvement which comprises continuing to blow air optionally enriched with oxygen into the molten copper or matte until the residual oxygen content of the molten copper reaches a value of not more than 0.3 percent by weight, and thereafter adding to the molten copper a treatment agent in the form of a body of porous coke impregnated with sodium, potassium, calcium, magnesium or an alloy containing at least 20 percent of one or more of these.

2. In the refining of copper wherein air optionally enriched with oxygen is blown into molten copper or matte, the improvement which comprises continuing to blow air optionally enriched with oxygen into the molten copper or matte until the sulphur content of the copper is 1 percent by weight or less, and thereafter adding to the molten copper a treatment agent in the form of a body of porous coke impregnated with sodium, potassium, calcium, magnesium or an alloy containing at least 20 percent of one or more of these.

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