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[54] **BRIQUETTE FOR PRODUCING ALUMINUM-SILICON**

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[58] **Field of Search** ..... 75/148, 10 A, 10 R, .5 R

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[57] **ABSTRACT**

The briquette of the invention comprises the following components in the following weight percentage: carbonaceous reducing agent, 30 to 40; alumina, 4 to 25; kaolin, 8 to 40 and disthene sillimanite, the remainder.

2 Claims, No Drawings

BRIQUETTE FOR PRODUCING ALUMINUM-SILICON

The present invention relates to the electrometallurgy of aluminium and silicon and more particularly to a composition of briquettes used for producing aluminum-silicon by the ore reducing smelting process in an electric-arc furnaces.

In accordance with the known processes, aluminium is produced electrolytically from high-alumina bauxites (containing more than 50 per cent of Al_2O_3). Silicon is produced by the ore reducing smelting process from quartzites having a low content of alumina in their composition.

Long and extensive research has been conducted all over the world to find a way to use natural aluminium silicates with aluminium and silicon as the principal elements of their composition for the production of aluminium-silicon alloys.

As a result of such research work, a process has been developed in the Soviet Union for the production of aluminum-silicon briquettes by subjecting the ore to a reducing smelting process in an electric-arc furnaces having a composition featuring enriched kaolin $3(Al_2O_3 \cdot 2SiO_2)$ but low in iron, and containing from 37 to 38 weight per cent of aluminium oxide and from 0.6 to 1.0 weight per cent of ferric oxide, and alumina containing 98 to 99 per cent of Al_2O_3, with the use of various carbonaceous materials as redicing agents such as gas coal, petroleum coke, and the like.

The above-specified charge composition (briquettes) for the production of aluminum-silicon is, however, not free from essential disadvantages.

During the course of the ore reducing smelting process, the briquettes become fused prior to the commencement of the reduction reactions due to the formation of mullite from the kaolin which proceeds according to the following schematic equation

$$2(Al_2O_3 \cdot 2SiO_2) \longrightarrow Al_2O_3 \cdot 2SiO_2 + 4SiO_2$$

at temperatures of up to 1550°C.

If the stock is not regulated and descends into the reducing zone and with frequent fall-ins of the charge the formation of air holes, which, on the one hand, leads to the reduced metallic phase being contaminated with a considerable quantity of unreduced briquettes and, on the other hand, to the entrainment through such holes of considerable quantities of the charge and of gaseous suboxides of aluminium and silicon.

The so-called master alloy obtained from the furnace therefore contains a considerable quantity of slags in the form of unreduced aluminium, silicon oxides and carbides. Usually the content of such slags in an alloy is from 12 to 15 weight per cent; when the alloy is decanted, these slags retain approximately the same amount of the reduced metallic phase. The total yield of the master alloy in the form of aluminum-silicon comes to from 65 to 68 weight per cent. In a subsequent conversion the consumption of electrolytic aluminium for the production of silumin is about 720 kg per ton.

The object of the present invention is to provide briquettes for the production of aluminum-silicon whose composition would be such as to allow optimal electrical and thermal conditions for the furnace operation and thereby a substantial improvement in the technical and economic characteristcs of the production of aluminum-silicon by the ore reducing smelting process

through lowering the consumption figures for electric power and the main stock materials.

This said object is accomplished by the provision of a briquette for the production of aluminum-silicon by the ore reducing smelting process in electric-arc furnaces, with comprising a carbonaceous reducing agent, alumina and kaolin, with the composition of the briquette, according to the invention, additionally incorporating disthene silimanite, and the weight percentage of the components in the composition being:

carbonaceous reducing agent	30 to 40,
alumina	4 to 25,
kaolin	8 to 40,
disthene sillimanite	the balance.

The composition proposed herein is characterized by the fact that the natural aluminium silicate, namely, disthene sillimanite, contains from 10 to 20 weight per cent of disthene which has the highest thermodynamic strength as compared to other aluminium silicates and forms, upon heating, a mixture of mullite and silica which has a melting point in the liquid phase of about 1810°C. This circumstance allows for the reduction of the oxides from the yet unmolten charge in the case of thorough mixing of the oxides with the reducing agent.

At the same time the present composition makes possible the reduction of aluminium and silicon to be performed in maximum amounts thereof, with the smelting process products having a diminished slag content. Moreover, with the use of the herein-proposed composition conditions are created which contribute to carbides being formed in smaller amounts thus lowering the electric conduction of the furnace and, hence, better utilization of the productive capacity of the furnace.

The use of disthene sillimanite in the composition of the briquette enhances the sintering of the charge on top of the ore heat-treating furnace due to an increase in the quantity of the mineral component in the composition of the briquettes. This contributes to a more uniform running of the furnace without the formation of air holes and the falling-ins of the charge, as well as to the stable state of the middle portion of the furnace, the latter being one of the major sources of unreduced oxides.

Laboratory tests of the present composition of the briquette have shown that with the processes for reducing the kaolin-alumina charge and of the charge incorporating the above-specified addition of disthene silimanite being run in parallel at a temperature of 1750°C, the reduction of the charge having disthene silimanite is brought to considerably higher degree of completion within a shorter period of time (after 65 minutes the reduction of the kaolin-alumina charge reaches 90 weight per cent and is practically completed, whereas the charge having disthene sillimanite is reduced to 98 to 99.5 weight per cent).

An illustrative example of the embodiment of the present invention is given hereinbelow.

The composition of the briquettes employed was as follows (in weight per cent):

disthene sillimanite	20
kaolin	25
alumina	25
carbonaceous reducing agent	30

The charge for the briquette was prepared by maxing the components with an accuracy of ±1 weight per cent in continuous-action batchers, mixing the components and subsequently briquetting the composition on roll presses with the addition of a binder, namely, alcohol-sulphite lye to a humidity of 14 to 16 per cent, this being followed by drying in gas-heated apron dryers at a temperature not above from 200° to 230°C to a 1% humidity. The mechanical compression strength of the ellipsoid-shaped briquettes from 60 to 40 mm in size was 120 to 180 kg/cm².

The process characteristics for the production of aluminum-silicon in a furnace with a capacity of 11 Mw are given in the Table 1 which follows.

Table

	Kaolin-alumina briquettes	Briquettes with disthene sillimanite
7. Power consumption per ton of aluminum-silicon, in kWh	10800	10200
2. Consumption of stock materials per ton of aluminum-silicon, in kg:		
(a) kaolin	2400	1700
(b) alumina	880	780
(c) disthene sillimanite	—	480
3. Consumption of electrolytic aluminum per ton of silumin, in kg	718	700
4. Composition of aluminum-silicon, weight per cent:		
silicon	38	37
aluminium	57	60
iron	1.6	1.5
titanium	0.65	0.65
5. Yield of aluminum-silicon, weight per cen.	67	72

What is claimed is:

1. A briquette for producing aluminum-silicon by the ore reducing smelting process in an electric-arc furnace, the briquette composition comprising, in weight per cent:

carbonaceous reducing agent, 30 to 40;
kaolin, 8 to 40;
alumina 4 to 25; and the remainder
disthene sillimanite.

2. The briquette of claim 1 comprising, in weight percent:

carbonaceous reducing agent, 30;
kaolin, 25;
alumina, 25; and
disthene sillimanite, 20.

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