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IN RELATION TO TREASON OF SPECIFIC ELECTRIC RESISTANCE OF CHARGE DURING SMELTING HIGH-CARBON FERROMANGANESE

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Character of treason of specific electric resistance of different composition of charge materials is investigated for smelting of the ferromanganese from the change of charge temperature. The experimental data are got specify on nonlinear character of the indicated dependence.

Keywords: high-carbon ferromanganese, ore-thermal furnace, charge materials, them specific electric resistance, researches

Entry. A ferro-alloy production is one of most industries of production the future of which is related with further development of electro energy base. Technological processes which take place in bath of ore-thermal furnace are very various. Important property of charge for the making of ferro-alloys in ore-thermal furnaces is them specific electric resistance. Its value at other things being equal depends on a quantity and grain-size distribution of components of charge materials and grows with the increase of their temperature [1-5].

Raising of task. A research purpose is working off the methods of making of information on treason of specific resistance of charge materials for smelting high-carbon ferromanganese from a temperature at different correlations of components of charge and exposure of such dependences.

Main part of researches. Research was executed on the experimental apparatus that worked out by authors.

For heating of charge materials to the temperature of fusion we used the Tammany furnace. The investigated material was disposed in ceramic crucible on the midwall of which placed two steel plastins which by means of electrodes are shown out outside a furnace. Measuring of temperature of charge materials in a range 200-1100 °C carried out with the use of laser and optical pyrometers. During an experiment we fixed indications of the milliammeter, laser and optical pyrometer, and also treason of level of charge materials in crucible.

In quality the investigated material we used charge material for melting to the ferromanganese 78 (*FeMn*78) that consisted of raw material which contains a manganese, coke, limestone and ferriferous metallic additions [2]. Depending on enriching of manganese ore or concentrate for the making of one ton high-carbon ferromanganese it use the different quantity of charge materials [3]. During an experiment we are investigated a charge with the below brought composition over of components (see a table 1).

During implementation of the experimental melting's of ferromanganese for melting No 1 we are chosen the minimum value of component charge materials, for melting № 2 - a mean value of component charge materials and for melting № 3 - them maximal value.

Table 1 - Composition of materials of charge for smelting ferromanganese

Number of melting	Charge materials, %			
	Manganese	Coke	Metallic shaving	Limestone
1	68.59	16.45	4.01	10.95
2	62.79	16.28	6.98	13.95
3	78.57	14.29	7.14	0

Treatment of results of experiments was executed thus. With the use of Ohm law for the electric circles of direct-current at the different temperature of charge materials expect its electric resistance

$$R = \frac{U}{I} \ , \tag{1}$$

where R – total resistance of charge materials, Ohm; $R = \rho \cdot \ell / s$, ρ – specific resistance of charge materials, $mm^2 \cdot Ohm/m$; ℓ – distance between plates, m; S – an area of surface of plastins, mm^2; U – voltage, V; I – strength of current, A.

The specific value of resistance ρ of charge materials we are calculated on a formula, which takes into account the geometrical parameters of plastins, to which voltage is skipped through.

$$\rho = \frac{S \cdot U}{I \cdot l} \ . \tag{2}$$

During heating charge materials change the physical properties, and in particular density, as a result there is their flash in crucible. As a result, the area of contact of materials of charge changes with the plates S, the values of which expect after a formula:

$$S = a \cdot (b - \Delta b) \ , \tag{3}$$

where a – a width of plate; b – an initial height of filling to crucible by charge materials in relation to a plate; Δb – flash of charge materials.

Steel plates, that it is placed in crucible one opposite other, have an almost rectangular form and will cut distance inter se that is why in calculations we are accepted arithmetical mean distance between plates.

The results of researches showed that in the interval of temperatures 250-750 °C specific electric resistance of charge materials for smelting to the ferromanganese changes in a small range. At temperatures 750-1100 °C we look its decline, that, in turn, it is predefined by phase transitions during the gradual melting of charge materials [4]. At achievement in the bath furnaces of liquid phase its specific resistance does not almost change. It is set that, with the increase of mass fate of coke and metallic shaving, specific resistance of charge materials (melting No. 2) diminishes. It is related to that only mentioned components are electricity-conductive and, in turn, provide burning of arc between electrodes in a ore-thermal furnace.

Conclusions. By means of the higher described methods of realization of experiment it was succeeded to get dependences of specific electric resistance for different composition of charge from a temperature charge. As a result of the conducted experiments evidently, that the small mass change of charge components considerably influences on specific resistance. At the further modeling of melting

process in a ore-thermal furnace it is important to know specific resistance of charge at any temperature, so as it has variable character.

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