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SOME ASPECTS OF MODELING OF THE STEEL-MAKING PROCESS

Annotation. The article discusses some aspects of the electric steel making process. It is shown that the production of electric steel mainly consists of three units - preparation of the charge, melting and pouring of the liquid became. At the same time, in the mixed mathematical model there are equations of both functional and correlation coupling. This reflects the function of the deterministic-static model. It is shown that, depending on the installation of all these models, they can be used in electric steel making.

The production of electric steel is associated with complex physicochemical processes, and some of these processes are either difficult to control or impossible to control [1]. At present, all the physicochemical processes controlled in order to obtain the required chemical composition of electric steel can be divided into two main groups [2]: metal refining; deoxygenation and alloying of the metal.

Innovative metallurgical technologies require the control of electric steel melting processes based on accurate calculations, which is possible through mathematical modeling of these processes. Mathematical modeling allows: first, to successfully solve different types of problems without conducting production experiments; second, to ensure optimal regimes of alloys under specific production conditions [2, 3].

The mathematical model of the process of electric steel making is a system of equations that connects the factors influencing this process with its parameters [3]. The mathematical model of the solution serves as a prerequisite for creating an algorithm for the process. By this is meant the sequence of calculations to be performed, which allows for a complete and accurate description of the calculation process. The algorithm of the solution is usually slightly broader than the mathematical model, because it can contain not only mathematical notation, but also logical conditions and other elements [4, 5].

Several complete and incomplete mathematical models differing in the scope of the parameters; due to the ability to take into account changes in parameters over time - static and dynamic; It is possible to compile statistical, deterministic and mixed types according to the method of compilation. At present, the physical and chemical bases of electric steel production processes are well studied. That is, the theoretical data obtained allow to establish a functional relationship between the final values of the main parameters of the smelting process and most of the factors that significantly affect them.

Thus, in our opinion, using the thermodynamic data of electropolarization, it is possible to create reliable statistical mathematical models consisting of equations expressing functional relationships with maximum limitation of regression equations [6].

Using the capabilities of mathematical modeling, let's determine the amount of poses formed in the process of melting electric steel. It is known that posa is a component that has a significant impact on the quality of molten steel, the profitability of the smelting process, the environment and other parameters such as waste.

Usually, in an electric arc furnace, steelmaking is carried out by the main process. Therefore, in the main process, it is important to determine the amount of posa. On the one hand, the main posa plays an important role in the removal of harmful additives, on the other hand, it can contaminate the liquid metal. Therefore, it is important to determine the amount of poses formed in the electric steel as a whole or in certain melting cycles.

In the initial stage of the process in electric steel smelting, the amount of iron oxides in the pose depends mainly on the temperature and is usually 25-35%. To determine the melting regime, it is necessary to know the amount of initial poses formed at the very beginning of the process. In this case, most of the information about the parameters of the solution is still unknown. Therefore, it is not possible to use the above formulas to determine the amount of posa at the initial stage of the process.

Calculations usually provide information on the composition of the metal scrap used in electric steelmaking. The porosity of the pose B, the amount of silicon oxide coming from other sources, as well as the amount of SiO_2 in the pose can be taken in the range of variations we encounter in practice.

Thus, by combining mathematical models of individual smelting cycles, it is possible to determine other parameters of the smelter as a whole, including the residual amount of additives in the metal, select specific variants of the posa mode of individual processes, calculate the consumption of various process additives and then make necessary adjustments.

Conclusion. Thus, in general, the creation of a mathematical model of melting processes of electric steel implies the following: to decompose the melting process within the limits of each period; to mathematically describe each elementary process; write a mathematical model by composing parameters and elementary processes controlled on the basis of equations of material and heat balances; to obtain a mathematical model of the solution as a whole by combining mathematical models of different periods. Thus, as an integral part of the mathematical model of melting, an analytical model has been proposed to calculate the amount of poses formed in the process of melting electric steel.

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