Development of ways of increase of ore-heating electric furnaces for production of ferroalloys efficiency

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Abstract **Ways of increase of ore-heating electric furnaces, used for production of ferroalloys, efficiency are considered. The advanced system of automatic control of the ore-heating furnace providing improvement of technical and economic indicators of technological process and adaptability to quality of burden stocks is offered.**

Keywords **Ore-heating electric furnace, efficiency, technical and economic indicators, system of automatic control, electric mode, regression model, electric characteristics.**

I. INTRODUCTION

Problems of increase of efficiency of ore-heating electric furnaces (OHEF) are difficult as the choice of rational electrotechnological operating modes of OHEF with high rates of efficiency is a multiple-factor task in which efficiency indicators (furnace productivity, a specific power consumption, an output of the leading element, etc.) depend on a large number of the influencing factors which include chemical and particle size distribution of burden stocks, their humidity, the electric mode etc.

From melting to melting quality of burden stocks can change (change of suppliers of ore, etc.) therefore adaptation of the electric mode of melting (current of electrodes, voltage of the feeding transformer) to furnace charge is necessary.

II. ADVANCED CONTROL SYSTEM OF ORE-HEATING ELECTRIC FURNACE

Besides such actions as control of a condition of lining and forecasting of term of its service, optimization of the modes of water and air cooling of elements of a design of the furnace, etc., creation of an advanced control system belongs to actions for increase of efficiency of OHEF.

The classical control system of OHEF consists of current regulators (separate for each of phases), and regulation of current is carried out by movement of electrodes of the furnace, and switch of steps of voltage of the transformer. The advanced control system assumes automatic formation of the electric mode (a set value of current and a step of voltage) providing the best technical and economic indicators at the current furnace charge.

In the course of melting operation electric parameters (currents, voltages, active and reactive power) are continuously measured and their values together with the technological parameters of furnace charge entered manually are added to archive of melting operations which is formed during operation of the furnace. Processing of archive of melting operations allows to relate the regression model

$$Y = f(x_1, x_2, \ldots, x_n, I, P_a), \qquad (1)$$

where Y – the integrated indicator of efficiency of process considering (with various weight coefficients) the furnace productivity, a specific power consumption, an output of the leading element, etc., x_i – the influencing technological parameters. On the basis of model (1) the system finds values of current of electrodes I and active powers P_a which at the current technological parameters of furnace charge give the best value of an integrated indicator of quality Y. According to the electric characteristics of the furnace [1] (dependence of active and useful power on current for each step of voltage) which are also continuously updated by results of electric measurements during melting voltage step gets out.

The system can work in regime of the adviser of the operator or in the supervisory mode.

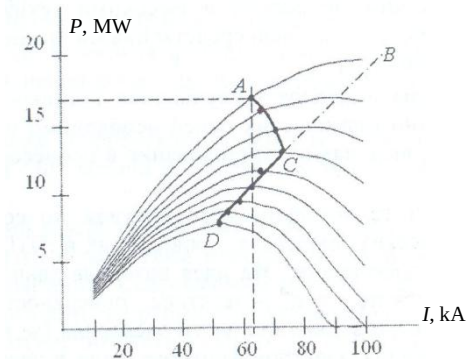

Fig. 1. Electric characteristics of the ore-heating furnace

III. CONCLUSION

The advanced control system with the automatic analysis of archive of melting operations and the accounting of electric characteristics of the furnace allows to improve technical and economic indicators of production of ferroalloys and provides adaptability to quality of burden stocks.

IV. REFERENCES

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