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The Application of Pulsating Resonance Fuel Burning during Steel-Teeming Ladles Drying and Heating Processes

In ferrous metallurgy in addition to the basic metallurgical industries a number of ancillary areas are also significant consumers of fuel. Among these consumers the ladle preparation is stood out, namely the processes of drying and heating of ladle linings. These processes often use scarce and expensive natural gas in a large amount.

In order to reduce the consumption of natural gas it is advisable to use pulsating resonance fuel burning. It is supposed that it:

- more thorough heat treatment of the inner surface of the ladle working volume by eliminating stagnant zones insufficiently washed with products of combustion;
- intensification of heat exchange between combustion products and the ladle lining;
- improved fuel efficiency due to the reduction of unburnt fuel.

There are three options of the pulsating resonance fuel burning mode excitation: pulsations excitation on the gas pipeline, on the air pipeline and simultaneous excitation of pulsations on the gas and air pipelines.

The objective of this work was to evaluate the applicability of the pulsating resonance fuel burning for drying and heating processes of steel-teeming ladles through the introduction of the developed system and evaluation of its performance in industrial conditions.

Experimental-industrial research had shown a high efficiency of developed pulsating resonance fuel burning when drying and heating of steel-teeming ladles. Reducing the consumption of natural gas; and therefore, its savings were 2.7÷26.1% when drying ladles, and 19.5÷37.8% when heating.

As a result of the test of pulsating resonance fuel burning mode on the ladles drying stand it was found that work of the pulsation unit on the gas pipeline of the stand provided the gas consumption and the gas consumption changes in accordance with the technological instruction. In practice, the ability of searching the pulsating resonance frequencies in industrial conditions despite the negative impact of temperatures, acoustic interferences and equipment inertia was confirmed. The intensive course of the drying process allowed reducing the process time and thus shortened fuel consumption.

Test results of fuel burning pulsating resonance system in the ladle heating departments indicate the feasibility of using it since the pulsating resonance mode allows to force the heating for melting by the flame resonance pulsation along with an increase in the gas consumption.