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ECONOMIC EFFICIENCY FOR APPLICATION OF WATER-COAL FUEL IN HEATER FURNACES OF ROLLED PRODUCTION

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Methods of assessing the economic and technical efficiency of natural gas replacement with coal-water fuel for heating furnaces of rolling production was proposed. On the example of continuous furnace of the rolling mill, it was shown that the use of coal-water fuel at current prices for natural gas and coal can reduce fuel costs by 47 %. The influence of various factors on the efficiency of coal-water fuel in furnaces of rolling production was reviewed.

Keywords: natural gas, coal-water fuel, continuous furnace, saving of natural gas

First a water-coal fuel (WCF), as an alternative to natural gas and masout fuel, was examined in the period of fuel crisis of seventieth years of the last century. Presently technologies of production and transporting WCF toend usres can consider worked out, and self WCF- ready to the use as a basic fuel for the heat aggregates of metallurgy and heat-powre engineering.

Coming from assumption that after replacement of fuel temperature mode of furnace, the productivity and eventual parameters for heating of metal does not change, equation got for determination of expense of water-coal fuel and cost effectiveness on the item «Technological fuel»:

$$B_{w-c,\text{f}} = V_{ïg} \cdot K_{ïg-w-c,\text{f}} \text{ , kg/with,} \quad (1)$$

$$E = \left(1 - \frac{C_{w-c,f}}{C_{ng}} \cdot K_{ng-q-c,f}\right) \cdot 100 \text{ , \% ,} \quad (2)$$

where $V_{ïg}$ – an expense of natural gas, m^3/s; $K_{ïg-w-c,\text{f}}$ – a coefficient for replacement of natural gas by water-coal fuel, kg/m^3; $K_{ïg-w-c,\text{f}} = Q^w_{sïg} \cdot \eta_{ïg} \Big/ Q^w_{sw-c,f} \cdot \eta_{w-c,f}$ $Q^w_{sïg}$ – more subzero working warmth of combustion of natural gas, $MJou/m^3$; $Q^w_{sw-c,f}$ – more subzero working warmth of water-coal fuel, MJou/kg; $\eta_{ïg}$, $\eta_{w-c,f}$ – coefficients of the use at heat furnace by natural gas and by water-coal fuel, accordingly; C_{ng}, $C_{w-c,f}$ – accordingly cost of water-coal fuel, hrn./t, and natural gas, hrn./thousand m^3.

As replacement of natural gas for a methodical furnace a water-coal fuel on the basis of «G» brand coal is chosen, at the mass concentration of coal in a fuel 62 %. the more Subzero warmth of combustion for water-coal fuel – 13.41 MJou/kg, a cost is a 1621 hrn./t, a coefficient of fuel replacement ($K_{ïg-w-c,\text{f}}$) for the examined furnace is 2.90 kg/m^3.

As researches showed, replacement of natural gas by water-coal fuel in a methodical furnace allows to provide cost effectiveness on the item «Technological fuel» at the level 47 %. However, there is a problem with providing of the given level of temperatures in the high temperature areas of furnace, as a calorimetric temperature of burning of water-coal fuel is 1930 ºC, that on 206 ºC the below calorimetric temperature of burning of natural gas. For the solution of this problem in work next measures are offered:

– increase of calorimetric temperature of burning of water-coal fuel by the increase of temperature of heating of air;

– change of temperature mode of furnace;

– heating of high temperature area of furnace by a fuel, characterized by more high calorimetric temperature of burning (for example, by natural gas, or mixture of natural gas with a water-coal fuel).

The analysis of the offered measures showed that the first measure was most effective. So, increase of temperature of heating of air from 250 to 350 ºC provides realization of the given temperature mode of furnace in all heated areas and decline of expenses on a fuel (as compared witan heating of furnace by natural gas) on 50 %. Realization of the second measure results to decline of factors of energy efficiency of furnace from the redistribution of the thermal loading on the areas of heating and increase of temperature of smoke gases which get-away from a furnace. As a result an economic effect from realization of the second measure is 43 %. At realization of the third measure a most economic effect is 36.7 % and it is arrived at the use for heating of high temperature area of furnace by mixture, consisting of a 30 % natural gas and 70 % water-coal fuel.