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FEASIBILITY OF APPLICATION OF STEP-BY-STEP AIR SUPPLY IN COKE OVENS OF DIFFERENT HEIGHTS

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The research was carried out with the aim of identifying the impact of a step-by-step approach air into the vertical of the coke oven by the amount of nitrogen oxides formed.

Numerical modeling using ANSYS-FLUENT programs. 3D models of verticals were built, in which the combustion processes of heating gases were simulated.

It is known that the amount of NOx formation is affected by the temperature in the flame. Searching for ways to reduce the maximum flame temperature in the vertical without reducing the amount of heat transferred to the coal charge is a promising direction.

Modeling of various options for the design of furnaces of different heights showed that recirculation reduces the amount of NOx formation by no less than half, and the organization of the second stage of air supply - by an additional 10-30 %, depending on the location of the second stage in height and the amount of air supplied to it. Adding each new air supply stage beyond two reduces the efficiency from each new addition, so the arrangement of two air supply points has been considered as optimal. The optimal height of the location of the second stage of secondary air supply has been also found.

For furnaces up to 7 meters high, the arrangement of a staged air supply is justified if, in addition to recirculation, it ensures a more uniform heating of the coal load in height, but the concentration of NOx is slightly reduced.

It has been found that the addition of the second stage of air in the ovens of small height, less than 7 m, can cause overheating of the top of the furnaces, which will lead to deterioration of the quality of coke in these areas. Therefore, step-by-step air supply to the verticals of such furnaces should be implemented with caution, taking into account other factors, in particular, the parameters of the charge.

Maximum flame temperatures when heated with mixed gas are lower than those for coke gas, which opens up greater opportunities for reducing NOx when using this gas.

Keywords coke ovens, batteries, step-by-step air supply, heating gas combustion conditions, recirculation of combustion products, mechanism of formation, thermal nitrogen oxides, coke ovens heating system, reduction of nitrogen oxide formation volumes, refractory brickwork.

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