

Contents

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RECONDITIONING REPAIR OF KB №. 5 AND 6 IN THE CONDITIONS OF THE OPERATING PRODUCTION OF PJSC «PJSC «ZAPOROZHCOKE»

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It is known that a coke oven battery has limited operational and adjustment resources, which are maximum when it is adjusted and put into operation. During operation (after 15-20 years of operation), the production potential of coke oven batteries decreases for a number of reasons: masonry wear, piers deformation, maintenance equipment and machinery wear, reduced adjustment capabilities of the heating system, which inevitably affects productivity.

Reducing losses in blast furnace coke production can be ensured by the following measures: reduction in the number of coke oven drills due to measures to control and restore the heating mode; reducing the number of maintenance furnaces by conducting ongoing and overhauls of the refractory masonry with an increase in the single load of the coking chamber; Minimizing equipment downtime by increasing its reliability through preventative maintenance and repair planning.

Compliance with the quality characteristics of products is impossible without maintaining fixed assets in working condition. To achieve these goals, overhaul of the refractory masonry of the coking chambers of batteries No. 5, 6 is carried out. The project with a total budget of \$ 20 million is planned to be implemented in stages under the conditions of the existing production for six years. The phased withdrawal of coking chambers for repair allows not to completely stop the coke oven battery, but to continue its operation, only partially reducing production, and to predict in advance the value of this decrease in accordance with the current Instructions for calculating production capacity.

Conducted earlier, and also planned for 2019 repairs of all the walls to a depth of up to 4 verticals will increase the single load of coke ovens from 15.8 tons (2016) to 16.5 tons (2019), that is over then 4.4 %. The planned repairs on the transfer of the walls of the battery No. 6 provides up to 2022 to increase the one-time loading to 16.5 tons of the charge of actual weight against 15.4 tons in 2018, which will increase the coke production by the battery by 7.1 %.

Keywords: coke oven battery, refractory masonry, service life, overhaul, coke production.

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THE DEVELOPMENT OF PRACTICAL RECOMMENDATIONS FOR MINIMIZING THE COST OF CRUSHED COAL AND REDUCING THE CONTENT OF A CLASS LESS THAN 0.5 MM AT PJSC "ZAPOROZHCOKE"

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Coal preparation technologies have always been of interest, and recently, due to the increase in the import component in the raw material base, the coking of Ukrainian enterprises has become especially relevant. So, in general, in 2018, the share of domestic coal in METINVEST HOLDING LLC enterprises amounted to only 27.2%. At the same time, 35.9% was delivered from the USA, 32.8% to Russia, and Canada – 7.1 % to coal concentrates. The transition to an inter-basin raw material base for coking using a large amount of petrographically heterogeneous coal required the adjustment of the technology for their preparation for coking. In addition, it is necessary to take into account the appearance of coals with a high content of particles with a particle size of less than 0.5 mm.

PJSC “ZAPOROZHKOKE” carried out industrial studies, during which they determined the effect of the amount of the supplied initial (non-crushed) coal charge on the energy consumption spent on its grinding. It has been established that an increase in the degree of coal metamorphism, expressed as a decrease in the volatile matter yield and an increase in the vitrinite reflectance, leads to an increase of the content of fineness fraction less than 0.5 mm when crushing. An increase in the content of fusinized components also leads to a similar result.

It has been shown that with an increase in the amount of coal blend passed to the crushing from 300 to 450 t/h, the amount of the undersize product decreases from 37.7 to 20.7 % or from 113.41 to 93.13 t/h, as well as the number of coal particles with a fineness of less than 0.5 mm in the crushed charge from 37.9 to 39.3 % or from 114.04 to 176.81 t/hour. At the same time, the amperage during crushing increases linearly, and the electric power consumption for

crushing increases to a certain maximum (375 kW), which corresponds to a load of ~ 300 t/h.

The use of an additional stationary sieve along with the existing string one for screening of a small classes, allows to increase the screening efficiency by 10.4–11.0% when the coal load is 300-350 t/h and at the same time to reduce the content of the class less 0.5 mm in crushed blend by 3.2-3.3 %

Keywords: coal concentrates, blend, preparation scheme, screenings, electric power consumption, hammer crusher.

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THE RATIONAL USE OF PRODUCTION CAPACITY OF PJSC “ZAPOROZHCOKE” FOR CAPTURING OF BENZENE HYDROCARBONS AND GETTING CRUDE BENZENE

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The article shows the results of a survey of the existing benzene hydrocarbon capture scheme of PJSC “ZAPOROZHCOKE”, on the basis of which it was decided to fundamentally modernize the scrubber compartment of the benzene recovery plant.

The results of the survey of the existing scheme of purification of coke oven gas from benzene hydrocarbons showed that the existing non-packing devices have disadvantages: high energy consumption for pumping oil; significant oil losses; low degree of oil spraying in redistributive devices; irrigation of the contours with saturated oil from the bottom of the scrubber. The decision was made to fundamentally modernize the scrubber department with the transition from nozzle irrigation to packing.

The corrugated Sulzer Mellapak Plus (type 252Y) packing was selected as the optimal one. The calculation of the mass transfer coefficient on this packing for the conditions of processing of coke oven gas in the benzene scrubber of PJSC “ZAPOROZHCOKE” has been presented.

The main characteristic of the corrugated packing is the specific surface area - the number of square meters of mass transfer surface per 1 cubic meter of the volume of the packing. Sulzer produces packings with a specific surface area of 350 m²/m³ and above, while a wooden chordal one, depending on the design, has a specific surface area of 50-120 m²/m³. Increasing this parameter increases the efficiency of absorption, but also increases the hydraulic resistance of the packing, as well as its tendency to clog with deposits.

The commissioning of the developed mass transfer surface significantly improved the economic performance of the scrubber-benzene department: the production of crude benzene increased by 9,6 % and the energy consumption decreased due to the decommissioning of five previously operated circulation pumps of the intermediate irrigation stages.

Keywords: coke oven gas, benzene hydrocarbons, absorption, scrubber compartment, benzene recovery plant, non-packing devices, corrugated packing, hydraulic pressure drop.

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THE MODERN USE OF CHROMATOGRAPHIC METHODS IN THE CONTROL OF COKE-CHEMICAL PRODUCTION

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The article considers the increasing role of chromatography in the quality control of products of coke plants. The using of the chromatography allows you to obtain more accurate and operational information about the composition of the multicomponent products and the presence and content of impurities.

The chromatographic methods have been described, which are used in PJSC “ZAPOROZHCOKE”, in particular, an improved method for determining the composition of coke oven gas, the results of which are used to calculate the combustion heat of gas going on the heating of coke ovens and an accelerated method for determining the content of benzene hydrocarbons in direct and reverse coke oven gas.

In determining the component composition of coke oven gas by chromatographic method, the individual representatives of saturated and unsaturated hydrocarbons are determined separately and not in total, as in the definition

according to GOST 5439-76. The chromatographic method is carried out on the principle of absolute calibration, ie for each component the dependence of the peak area on the volume fraction is established. This improves measurement accuracy, especially at low values of components concentration.

Depending on the task in the chromatographic measurement can determine the mass concentration of the benzene, toluene and xylene, and selectively each of all components of dimethylacetamide solution (all of which are absorbed by activated carbon in determination according to GOST 5439-76).

The advantages of the chromatographic method can be attributed to the constant conditions of chromatography, while the completeness of the absorption by activated carbon of benzene hydrocarbons depends on the temperature of steam and the rate of vaporization, filling the cartridge with coal, the correct determination of the cartridge ratio. In addition, when absorbed by benzene hydrocarbons from coke oven gas, the components of the absorbed oil that have entered it will also be absorbed by the activated carbon and bring uncertainty to the results.

The data for determining the mass concentration of benzene hydrocarbons by two methods are given: chromatographic and with absorption by activated carbon.

Keywords: chromatographic column, holding time, peak identification, accuracy of measurement, coke gas, combustion heat.

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THE PERSPECTIVE FOR EXPANSION OF THE SALES OF THE ELECTRODE PITCH AT PJSC "ZAPOROZHCOKE"

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The brief analysis of the situation on the world markets, first of all - the dynamics of world production of primary aluminum is given. It is shown that coal tar electrode pitch remains not only scarce but also practically an uncontested type of materials both now and in the future.

One of the major aspects that can limit the ability of electrode pitches manufacturers there are problems with the transportation of these products, especially over long distances. The solution of this problem may be to refuse of transporting of the pitch by thermal cisterns and to product a solid granular electrode binder.

The comparison has been given of two types of granulation apparatus, which are currently used at domestic coke plants. The advantages of structures that prevent direct contact of the pitch melt with cooling water has been shown.

The information has been given about a large investment project for the construction of the second electrode pitch granulation line, which is being completed this year by JSC "Zaporozhcoke". It will allow to increase by 30 thousand tons/year production of highly liquid granular pitch due to the product shipped in liquid form, and thus expand the market of production of production of the enterprise.

According to the project developed in 2017 by SE «GIPROPROM», the granulation department of electrode pitch No 2 will include: two discharge tanks for the liquid initial pitch with a capacity of 240 tons each, equipped with electric heating; granular unit "Rotofrom" with the tape cooler of Sandvic company, equipped with a bucket elevator, automatic system of loading of the final granular electrode pitch in "Big-Begs"; thermal catalytic unit for the disposal of harmful emissions; finished goods warehouse with two overhead cranes; water, electricity, steam and gas facilities from existing in-house networks. The building granulation department, in terms of technical equipment, automation and environmental safety, meets the highest modern standards in the world. The commissioning of the new electrode pitch granulation line is scheduled for May 2019.

Keywords: electrode pitch, consumption, alternatives, sales, thermal cisterns, granulation, internal porosity, capillary moisture.

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THE IMPLEMENTATION OF ENERGY-SAVING TECHNOLOGIES AT PJSC "ZAPOROZHCOKE"

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The article gives a brief description and the main technical and economic indicators of the three technological solutions implemented at ZAPORIZHKOKS PJSC in order to increase the energy efficiency of production processes both at the enterprise and at Zaporizhstal PJSC.

So, until recently, at Zaporizhstal PJSC, excess blast furnace gas was burned in a "candle", and natural gas was used to ensure the technological processes of the main and auxiliary production facilities. At the same time, PJSC "ZAPOROZHKOCS" practiced burning high-calorie coke oven gas in boiler units for steam production. In order to comprehensively solve the problem of reducing the consumption of natural gas, rational utilization of excess blast furnace gas burned on a "candle", and releasing coke oven gas resources for more efficient use, a decision was made to organize the exchange of blast furnace and coke oven gases. For this, reconstruction of the boiler equipment of PJSC "ZAPOROZHKOCS" was required in order to ensure the possibility of using 100% low-calorific blast furnace gas from the networks of PJSC "Zaporizhstal" for its heating. The economic effect from industrial implementation of optimized heating systems and from saving natural gas amounted to 208 million UAH per year.

Another problem of coke production, leading to significant energy losses, has been formulated: a decrease in its consumption for heating coke ovens during regular changes in the direction of movement of gas-air flows. During this period, due to a decrease in gas consumption, the pressure in the gas pipeline system increases sharply by almost 30%, and the excess gas is automatically sent to a gas discharge device to prevent an emergency. The industrial implementation of a coke oven gas pressure stabilization installation ensured an annual economic effect of more than 5 million UAH per year.

The data about the industrial implementation of electric fuses of gas burners and about the prevention of coke oven gas losses due to imperfections in shutoff valves and design features of the ignition device (annual economic effect of more than 4 million UAH/year) has been presented.

Keywords: electrode pitch, consumption, alternatives, sales, thermal cisterns, granulation, internal porosity, capillary moisture, economic effect, industrial implementation.

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