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INTER-BASIN RAW MATERIAL BASE OF COKE-CHEMICAL PRODUCTION OF UKRAINE: DOMESTIC AND IMPORT COMPONENTS

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The article materials shows the dynamics of substitution of Ukrainian coking coal by imported coals over the past 5 years. The analysis of the inter-basin raw material base of coking plants in Ukraine is given. It has been shown that the percentage of Ukrainian coking coal over the analyzed period has decreased from 43.6 % to 18.0 %, while the percentage of import Russian coal over this period has grown from 32.5 % to 45.6 %. The part of American coal increased from 11.8 % to 28 %. This is because that the rather significant assets in the Appalachian coal basin are owned by the Ukrainian company METINVEST HOLDING LLC, which consumes these coals in the amount of 90-95% of their total supply. The import dynamics of coals from Canada and Australia are also shown. Teck Premium coals are mainly supplied from Canada, and Peak Downs and Oaky North from Australia. In small quantities (within 1 % of the total supply) coal from Poland and the Czech Republic are attracted to Ukraine.

The data about the marcs name and about the properties of Ukrainian and imported coals that make up the raw material base of coking of Ukrainian plants are presented. It is shown that both now and in the future, the raw material base of the coke-chemical production of Ukraine will have an inter-basin character. In addition to traditional importers, the deliveries can be expected from Canada, Australia and Indonesia.

The basic Ukrainian coking coal is the coal of marc "K" of mine management "Pokrovskoye", enriched at coal preparation plant "Svyato-Varvarinskaya". The basic coals, which are imported into Ukraine from the United States are greasy and lean coking grades. The basic coals of Canada and Australia, imported into Ukraine, are coals of marc "K".

The risks connected with the supplying of coal by sea and rail were noted. These include weather conditions, delays with loading and unloading of vessels, which is fraught with a violation of the schedule of deliveries to coke plants. The rail transporting depends on the allocation of quotas and the availability of wagons. Risks according to the so-called sea coals should be compensated by sufficient reserves in ports and coal residues at coke plants. The threat of disruption of supplies of Russian coals of the gas group makes it necessary to search for alternative solutions at the expense of other suppliers.

Keywords: inter-basin coking raw material base, coal, import, coal marcs, risks.

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MOISTURE-HOLDING CAPACITY COAL OF DIFFERENT SIZE CLASSES

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It has been shown, that when forming the stamped coal cake in the stamping-loading-ejecting machine, the role of the binder is performed by the moisture of the blend, which is located in the intergranular space. Very actual is the fact that when solving this task, it is important to know the content of both external and internal moisture of the loading blend. However, the difficulty of quantitatively accounting for the external moisture in the charge is due to the fact that the total (working) moisture determined during the current control also includes the internal moisture of the coal, adsorbed in the sub-microscopic pores of the coal and firmly bound to the coal in the form of thin films. Even with a relatively large amount of internal moisture, the coal has good flowability. Therefore, when compiling

coal blends for stamping it is necessary to take into account the internal moisture of the coals. It is necessary for adjusting of the amount of water supplied to the humidification and of the level of grinding of the charge. This will eliminate the collapse of the stamped coal forms due to a decrease in its ramidity.

A method for determining the internal moisture (moisture-holding capacity) for the size of coal of different grades has been presented In this article.

The essence of this method consists in saturating a coal sample with water, bringing it into equilibrium with the atmosphere at a relative humidity of 96 % and a temperature of 30 °C and drying to a constant mass at a temperature of 105-110 °C. Determinations are carried out at low and atmospheric pressures. The maximum moisture capacity of coal is calculated as the mass fraction of moisture in conditioned coal.

It has been established that with a decrease in the size class the moisture-holding capacity of coal increases, and with an increase of the degree of coal metamorphism, the value of the moisture-holding capacity coal decreases.

For the practical use of the maximum moisture capacity parameter, it is recommended to accept the value of moisture saturation during the first 24 hours. After two days, the increase in humidity of almost all of the coals studied slows down due to saturation. In the period from 5 to 20 days, the increase in maximum moisture capacity is negligible and reaches to 0.07-0.12 %.

Keywords: coal, moisture-holding capacity, technique, size classes, degree of metamorphism.

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ABOUT THE FACTORS OF INFLUENCE ON QUALITY OF COAL TAR UNDER CONDITIONS OF THE EXISTING COKE-CHEMICAL ENTERPRISE

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In the period of 2017-2018 the density of coal tar at a number of coke plants in Ukraine increased to 1230-1250 kg/m^3, and the content of quinoline insoluble substances in it increased to 9-17 %.

The article shows the need and the ability to determine generalized parameters characterizing the process of formation of coal tar, the control of which would allow to determine the technological factors responsible for changes in its quality. This opens up the possibility for developing of the technological solutions for managing the quality of coal tar at the stages of preparing coal for coking and production of coke (to the extent that will not lead to a noticeable deterioration in the quality of the main product).

A long period (15 calendar months starting from January 2018) of production activity of PJSC "ZAPOROZHCOKE" was selected for the practical application of this approach, which has been characterized by a very wide change of the quality of coal tar of its own production. The analysis of a large array of production data showed: among the investigated parameters the correlation of the density of coal tar and the content of quinoline insolubles in it with the temperature of the free space of coke chamber is the most indicative. On this basis, it has been suggested that changes in the quality of coal tar are mainly due to temperature fluctuations in the free space of the coking ovens. This is confirmed by the averaged (monthly) data on the loading of coking ovens and coke output for the studied period. Since the level of heating of coke ovens is determined by the requirements for the quality of blast furnace coke, the only way to reduce the intensity of vapor-phase pyrolysis of coal tar components without negatively affecting the quality of the main product is to reduce the height of free space of the coke ovens.

Keywords: coking, coal tar, pyrolysis degree, coke oven, loading, free space of charged coke oven, temperature.

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THE USE OF INDUSTRIAL WASTE OF COKING COAL PREPARATION TO PRODUCE ELECTRICITY

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The problem of expansion of domestic energy resources by involving in the fuel balance of industrial waste of the enrichment of the coal is considered. It is shown the relevance for Ukraine of the development of technologies for the utilization of industrial coal preparation waste for the production of electricity and heat. A brief analysis of the current legislation in Ukraine in the field of waste management is presented.

There are considered the characteristics of typical high-ash coal enrichment waste of coking coal and gas coal. The impossibility of their use by pulverized coal-fired power plants is shown. The necessity of preliminary preparation of waste for the combustion process is substantiated. It is presented technical solutions for the fuel preparation of flotation waste of high humidity (W^r_t about 37 %) and high ash content ($A_d \approx 60$ %), coking coal and industrial product as fuel for environmentally friendly circulating fluidized bed technology. It is presented variants of electricity production based on the central heating boiler unit with a steam capacity of 75 t/h as part of a power unit with an electric capacity of 20 MW have been developed. Design data for the use of an intermediate product with a lower calorific value (per working mass, Q^i_r, kJ/kg) 16748 kJ/kg and flotation waste 9210 kJ/kg are presented.

The technological scheme and layout of the boiler unit with a central heating system for burning fuel at a temperature of 800-900 °C is presented. The developed technological solutions provides for the possibility of operation of the central heating system boiler unit as part of a TPP power unit with an electric capacity of 20 MW (condensing mode) in the regulation range of 60-100%. Electricity production is based on the operation of a steam turbine installation, in which the steam turbine SST-150 from Siemens, Germany, Has been chosen.

The economic aspects of implementation a technology for generating electricity based on a central heating boiler system are evaluated. When using flotation waste as the main fuel, the total expected capital expenditures will amount to 26.5 million US dollars, including 5.3 for the boiler; to a steam turbine installation - 6.8; for fuel preparation – 1.5. As a further development of the technology, it is envisaged to consider a complex project with the use of ash of circulating fluidized bed technology boiler upon the production of clincer.

Keywords: industrial coal preparation waste, high-ash coal; burning; steam generator; circulating fluidized bed.