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THE INFLUENCE OF DURATION ON THE PROCESS OF OBTAINING RAW MATERIALS FOR THE PRODUCTION OF PULVERIZED COAL FROM HIGH-SULFUR LOW-METAMORPHOSED COALS

© M.E. Shved, S.V. Pyshyev, Doctor of Technical Sciences, Yu.V. Prysazhny, PhD in technical sciences, Yu.V. Lypko (Lviv Polytechnic National University)

The influence of the duration of the process on the degree of sulfur recovery and the depth of conversion of the organic mass of coal, on which, respectively, the sulfur content and ash content and the yield of volatile substances of desulfurized coal depend. The interval of optimum values of the duration of the process is found at which it is recommended to carry out the process of oxidative desulfurization in order to obtain raw materials for the production of pulverized-coal fuel.

The increase in the duration of the process leads to a decrease of the output of de-carbonated coal and solid products as well as an increase in the yield of the desulfurizing resin. With an increase in the length of the process, the degree of conversion of organic mass of coal increases. At the same time, the ash content of desulfurized coal increases, and the yield of volatile substances decreases.

With an increase in the duration of the process, a decrease in the number of total and pyrite sulfur was observed, while the stages of extraction and conversion of sulfur increased (intensively up to 10-20 min. However, if the duration is more than 15 minutes. the content of sulfur dioxide in desulfurization gases decreases, which adversely affects its further extraction from these gases.

During oxidative desulfurization of low-metamorphosed coal type DH in a short interval (13.9-14.0 min.), it is possible to obtain raw materials for the production of PVP of grades № 3-4, and it meets the requirements for sulfur content, volatile matter and ash content.

With a duration of more than 45 minutes it is possible to obtain a desulfurized product meeting the requirements for raw materials for SURV No. 2 for sulfur content and the release of volatile substances. The required ash content can not be reached. To determine the values of the process parameters that will allow to obtain coal with a sulfur content of up to 1.2%, an ash content of up to 10%, and a volatiles yield of up to 38%, it is necessary to investigate the effect of the oxidant composition.

Keywords: pulverized coal fuel, oxidizing desulfurization, sulfur, coal, duration.

* Author for correspondence, e-mail: mari4ka.ved@ukr.net

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THERMOLYSIS OF COALS IN THE PRESENCE OF POTASSIUM HYDROXIDE

© V.A. Kucherenko, Doctor of Chemical Sciences, Yu.V. Tamarkina, PhD in chemical sciences, I.B. Frolova, PhD in chemical sciences, V.A. Saberova (InPOCC)

The article belongs to a series of articles by the author's team devoted to the development of the principles of alkaline promotion of various types of solid combustible minerals with potassium and sodium hydroxides. The purpose of the promotion is, in particular, a targeted effect on the surface reactivity of the processed material.

The thermolysis ($t \leq 500$ °C) of different rank coals ($C^{daf} = 80-92$ %) impregnated with potassium hydroxide at KOH/coal ratios $R_{KOH} \leq 10$ mmol/g has been studied by thermogravimetry and electronic paramagnetic resonance (EPR) spectroscopy. A quantitative estimate of contributing alkaline promotion of thermodestruction has been carried out using the difference in the weight loss rates $\Delta\omega_m$ obtained by subtracting the differential thermogravimetric (DTG) curves of coal from the DTG curves of coal-KOH compounds.

The KOH contribution to thermodestruction at $t \leq 300$ °C was established to be maximum for low rank coals due to the high content of aliphatic groups and decreases to zero in coals with C^{daf} 91 %. At 400-500 °C, the alkali promotes the thermodestruction of polyarene fragments and S- and O-containing heterocycles, which leads to a

significant (by a factor of 10-30) increase in the reactivity of high rank coals.

The temperature dependences of unpaired electrons concentration $[e^-]$ for thermolysis solids of "coal-KOH" compounds have been obtained. KOH in coal was established to be responsible for the local maximum $[e^-]$ at 250 °C; its manifestation increases with increasing R_{KOH} ratio. It was concluded that the thermoinitiated reactions of KOH and coal increased the yield of volatile products, changed coal radical concentration by creating steric hindrances to their recombination, and cleaved the C-O and C-C bonds of framework-forming organic chains.

Keywords: coal, alkaline impregnation, thermolysis.

* Author for correspondence, *e-mail*: Tamarkina@nas.gov.ua

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INFLUENCE OF HEATING RATE AND DEGREE OF OXIDATION ON THE IGNITION TEMPERATURE

* **D.V. Miroshnichenko, Doctor of Technical Sciences, V.Yu. Kramarenko, Doctor of Chemical Sciences (NTU "KhPI"), I.V. Shulga, PhD in technical sciences, Yu.S. Kaftan, PhD in technical sciences, N.A. Desna, PhD in technical sciences (SE "UKHIN"), Yu.V. Nicolaichuk (SHEI "DDPU")**

It is indicated that the speed of the total process of coal combustion is proposed to be considered within the framework of formal kinetics of the first order without determining of the rate constants of elementary reactions. Assumption of $n = 1$ significantly simplifies the mathematical description of the kinetics of the process without significantly affecting the accuracy of the results. This circumstance has been used in this work to kinetically describe the dependence of the ignition temperature of coal on its heating rate and oxidation state.

The equipment for the determination of coal oxidation is in accordance with DSTU 7611: 2014 "Hard Coal. Method of determination of oxidation and degree of oxidation" was used for conducting studies related to the determination of the effect of the rate of heating and the degree of oxidation of coal to its ignition temperature. Using the known Kissinger equation, the values of activation energy, the pre-exponential factor and the rate constant of the process of combustion of coal of varying degrees of metamorphism and oxidation were calculated.

It is shown that the equipment for determination of oxidation of coal according to DSTU 7611: 2014 "Hard coal. Method for determination of oxidation and degree of oxidation" can be used to determine the kinetic parameters of the ignition process. The parameters are determined within the framework of non-isothermal formal kinetics. It has been established that the that the ignition temperature of coal of various degrees of metamorphism and oxidation practically entirely depends on the heating rate. According to the developed mathematical equation, one can calculate the ignition temperature of the investigated coal in the range of its heating rate from 2 to 7 °C / min.

It has been found that the rate constant of the ignition process increases with degree of oxidation and the decrease of the degree of metamorphism of the investigated coal. The increase in the rate of ignition against the background of an increase in the activation energy is explained within the framework of the growth of a pre-exponential multiplier and its dominant contribution to the resulting value of the constant of velocity.

Keywords: ignition temperature, thermal analysis, formal kinetics, activation energy, Kissinger method.

* Author for correspondence, *e-mail*: dvmir79@gmail.com

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SYSTEM OF INTEGRATED PRODUCT QUALITY MANAGEMENT AT PJSC "ZAPOROZHCOKE"

* **V.A. Litovka, A.S. Gaidaenko, A.A. Bekhter (PJSC "ZAPOROZHKOCS"), A.Yu. Balasanyan (PJSC "DNIPROVSKIY COKE-CHEMICAL PLANT")**

The necessity of creating a system for integrated product quality management at the enterprise has been described. The principles of its development and the main stages of implementation have been illustrated by the example of the main product – metallurgical coke. It is shown that the use of an integrated quality management system is a prerequisite for ensuring the competitiveness of an enterprise in modern conditions.

The permissible ranges (zones) of the parameter values are indicated: "green" zone, in which a stable output is provided in accordance with the requirements of consumers; "yellow" risk zone; "red" zone, characterized by non-compliance of product quality with established requirements. Indicators that directly ensure the production of high-

quality blast furnace coke are recorded in technological journals and electronic accounting systems of the enterprise:

- the degree of grinding of the charge on the limiting grain content of less than 3 mm (grinding);
- the coefficient of uniformity of the coke;
- the duration of coke on the ramp;
- coke quenching / sludge cycle time under the quenching tower, etc.

For all indicators, a shift record is kept in the report of the enterprise dispatcher. If the parameters deviate to the "yellow" or "red" zones, the shop personnel take the measures described in the passport of the integrated product quality management system to return the parameter to the "green" zone.

The developed and implemented product quality management system takes into account the toughening of consumers' requirements, primarily to the quality of blast-furnace coke. The system covers all the main stages of preparation and implementation of production. This allows to ensure the release of products in accordance with the requirements of existing regulatory and technical documents.

In connection with the continuous change of external and internal factors, which significantly affect the conditions of production, it is necessary to have a systematic analysis of the efficiency of the system and its continuous improvement.

Keywords: coke-chemical production, products, quality, coal blend, blast furnace coke, technology, equipment, control measures.

* Author for correspondence, e-mail: office@zaporozhcoke.com

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DEVELOPMENT OF TECHNOLOGICAL PRINCIPLES OF OPERATION WITH THE SINTERING ABILITY OF ELECTRODE PITCH

* **V.V. Karchakova** (SE "UKHIN")

Based on an analysis of literary sources and existing production practice, it has been concluded that there is still no clear idea about the formation of a complex of consumer properties of pitch in the production of electrode binders from the initial ("raw") medium temperature pitch and the physicochemical nature of sintering of pitch with carbon fillers.

Methods of controlling the interaction of coal tar pitch with fillers during sintering have been studied in order to ensure the stable production of high quality electrode and graphite products.

It is shown that optimum wetting with pitches of the carbon fillers surface is a necessary but not sufficient condition for obtaining a solid pitch composite. As an alternative, it is proposed to determine the sintering ability of the pitch by the adhesive strength of its interaction with the fillers during carbonization. It has been shown that the modified method for determining the sinterability of a "pitch-carbon filler" opens up the possibility of promptly detecting the optimal ratio in the initial mixture for specific components under production conditions, thus reducing the fluctuations in the quality of the raw material being supplied to the production.

Based on the results of electron microscopic studies, it was shown that pitch binders in composites with carbon fillers do not form a solid carbon skeleton.

The multiple regression equations for the estimation of the bond between the indicators of wetting and sintering ability of the industrial electrode pitches with the parameters of the production mode of the electrode binder, as well as with other qualitative indices of the obtained pitches, were obtained. It has been shown that the wetting and sintering ability of electrode pitch can be adjusted within a sufficiently wide range by introducing plasticizers of carbonaceous origin, having a high affinity for the components of the pitch.

Keywords: coal tar pitch, electrode production, binder, filler, wettability, caking, sintering capacity

* Author for correspondence, e-mail: lerakarchakova@gmail.com

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ADJUSTMENT OF THE SECTORAL INSTRUCTION "INDICATORS OF POLLUTANT EMISSIONS" FOR COKE-CHEMICAL ENTERPRISES

S.A. Kravchenko, PhD in technical sciences, * **T.F. Trembach**, **M.V. Mezentseva** (SE "GIPROKOKS"), **A.S. Malysh**, PhD in technical sciences (SE "UKHIN")

The report discloses the concept of "emission indicator" - a value that characterizes the relationship between the amount of pollutant emitted into the atmosphere and the activities associated with this emission. Emission indicators are calculated per unit of production or raw materials in accordance with the level of scientific and technological progress, the state of the technological equipment, the efficiency of gas cleaning equipment and other technological parameters. These indicators are set for technological processes, installations and equipment.

The reasons and history of the implementation in Ukraine of normative industry average specific indicators of specific emissions are given; substantiated the need for their periodic adjustment.

The analysis of adjustments to industry instructions is given and the accepted changes are substantiated. For example, it is shown that for coke oven batteries of the same capacity, with an increase in the volume of ovens, the required number of furnaces in the battery is reduced, which in turn has an effect on parameters that can reduce the total amount of air emissions.

The report provides an analysis of the adjustment of the sectoral instruction and the accepted changes have been justified.

The new edition of the branch instruction contains the emission indicators that were developed taking into account the different modes of operation of coke batteries and fluctuations in the raw coal base at the industrial enterprises. In particular, it has been developed a correction factor that takes into account the volume of the coking chamber in the calculation of total emissions.

The parameters of the emission of benz(a)pyrene have been corrected taking into account the reduction of the emission at the dust-cleaning equipment of the dust-free coke plant.

Keywords: emission indicators, emission sources, coke production, pollutants.

* Author for correspondence, *e-mail*: ozos@giprokoks.com