

BALANCED INDICATORS OF THE PROCESS OF COAL GASIFICATION WITH WATER VAPOUR© **D.V. Bryk¹, S.D. Kalmuk²**

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The work is devoted to studying the issue of thermodynamic equilibrium in complex chemical systems with the compilation of equations of state that can be used to calculate the process of underground coal gasification (UCG) with water vapour. The equations proposed in the article allow, at a given pressure P and temperature T , to calculate the thermophysical parameters of geotechnological processes, namely: the quantity, composition and heat of combustion of gaseous products, the efficiency and heat of the process, optimal thermodynamic conditions, etc. Such calculations characterise the geotechnological process and provide a theoretical and economic basis for selecting optimal technological modes.

It has been shown that the use of steam-oxygen and water (steam) reagents for the coal gasification process can be considered one of the most effective means. Compared to air blowing, the use of water (steam) will increase the specific yield of the target gas, increase its heat of combustion, and the gas does not contain ballast – nitrogen.

The paper presents the results of calculating the equilibrium composition of coal gasification products for 'dry gas' in the pressure range of 0.4-32.4 MPa and temperatures of 1023-1273 K (750-1000 °C).

Analysis of the obtained theoretical indicators of the equilibrium composition of gasification products and the thermophysical characteristics of the process indicates that the optimal technological parameters are temperatures in the range of 850-1000 °C and pressures in the range of 4-10 MPa. At these parameters, the highest content of combustible components of generator gas (CO , H_2 , CH_4) and, accordingly, the lowest content of ballast – CO_2 and H_2O , as well as a high gas yield are observed. UCG process indicators can reach 70-75 % of the calculated values when using pyrolysis gases (16-24 MJ/m³).

The gasification process using water (steam-water) blowing will improve technological indicators by increasing the quality of generator gas (the gas will mainly contain CO and H_2), reducing energy consumption and, accordingly, reducing the cost of gross production.

Keywords: coal, gasification, geotechnological processes, products, mathematical modelling, thermodynamic conditions, equilibrium composition, optimal parameter.

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