

RESEARCH OF THE DEPENDENCE OF COKING PRODUCT OUTPUTS AND SPECIFIC HEAT CONSUMPTION FROM THE SULPHUR CONTENT OF THE COAL BLEND

Bogdanov S. A., Zbykovskiy O. I.

Donetsk National Technical University, Drohobych, Ukraine
oleksandr.zbykovskiy@donntu.edu.ua

This research is important for the formation of the raw material base, forecasting the expected results and achieving the economic efficiency of the industrial coking process.

The research was carried out using a linear mathematical model of coking product yields that best correlates with the results of industrial coking in modern coke oven batteries. The model uses two parameters of coal charge quality, which are determined in the process of technical analysis: volatile matter yield per dry weight V_{bl}^d and Sulphur content per dry weight S_{bl}^d . A wide range of variation of S_{bl}^d from 1.0 to 2.2 % was chosen, which corresponds to the possible values of this indicator at coke plants in Ukraine. A computer programme was developed based on the mathematical model. The initial data were taken as averages for PVR coke ovens with a useful volume of 30 m³. The calculation results are presented in Table 1.

Table 1. Dependence of coking product outputs and specific heat consumption from the Sulphur content of the coal blend

S_{bl}^d , %	q^r , kJ/kg	G_c , kg	$G_{d.g.}$, kg	$G_{res.}$, kg	$G_{b.h.}$, kg	G_{NH_3} , kg	G_{H_2S} , kg	$G_{p.w.}$, kg
1,0	2738,6	699,24	142,47	34,41	11,29	3,19	2,35	27,02
1,1	2738,4	699,24	142,32	34,37	11,28	3,18	2,58	26,99
1,2	2738,3	699,24	142,17	34,33	11,27	3,18	2,82	26,96
1,3	2738,1	699,24	142,01	34,30	11,25	3,18	3,05	26,93
1,4	2737,9	699,24	141,86	34,26	11,24	3,17	3,28	26,90
1,5	2737,8	699,24	141,71	34,22	11,23	3,17	3,52	26,87
1,6	2737,6	699,24	141,55	34,19	11,22	3,17	3,75	26,84
1,7	2737,5	699,24	141,40	34,15	11,21	3,16	3,99	26,81
1,8	2737,3	699,24	141,25	34,11	11,19	3,16	4,22	26,78
1,9	2737,1	699,24	141,10	34,08	11,18	3,16	4,46	26,76
2,0	2737,0	699,24	140,94	34,04	11,17	3,15	4,69	26,73
2,1	2736,8	699,24	140,79	34,00	11,16	3,15	4,93	26,70
2,2	2736,7	699,24	140,64	33,97	11,15	3,15	5,16	26,67

The increase in the sulphur content of the blend on a dry weight basis from 1.0 to 2.2 % leads to a slight decrease in the consumption of dry heating coke gas by 1.9 kJ/kg (0.07 %); a more than twofold increase in the output of hydrogen sulphide by 2.81 kg (119.57 %); reduction of dry coke oven gas output by 1.83 kg (1.28 %), coal tar output by 0.44 kg (1.28 %), benzene hydrocarbons output by 0.14 kg (1.24 %), ammonia output by 0.04 kg (1.29 %) and pyrogenic water output by 0.35 kg (1.30 %). At the same time, the coke output does not change, but as the sulphur content of the blend increases sulphur content of the coke grows and therefore means that its quality degrades. Thus an increase in the sulphur content of the coal blend leads to a decrease in the output of coking products except coke and hydrogen sulphide, worsens the quality of coke and accordingly is economically unprofitable.