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STATISTICAL ASSESSMENT OF THE ADEQUACY OF THE DEVELOPED MATHEMATICAL MODELS FOR GAS AND LEAN COAL BLENDS FOR PULVERIZED COAL INJECTION (PCI)

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The paper presents the results of a statistical assessment of the adequacy of the developed mathematical models for predicting the Hardgrove Grindability Index (HGI), Free Swelling Index (FSI), and ignition temperature (t_ign) of gas and lean coal blends intended for pulverized coal injection (PCI).
At the first stage, the additivity of these parameters was investigated using binary blends of gas and coking coals prepared under joint charge preparation conditions. It was established that the HGI of a blend tends toward the value of the harder component, the FSI toward the value of the less caking component, and the ignition temperature toward the value of the more easily ignitable component, indicating a systematic deviation from simple additivity. Based on the identified relationships, regression models were developed to correct the calculated values.
At the second stage, the applicability of the models was verified for predicting the properties of 12 variants of gas and lean coal blends (30–50% and 50–70%, respectively). Model adequacy was evaluated by comparing calculated and experimental values using the correlation coefficient, coefficient of determination, standard deviation of residuals, mean absolute error, and systematic bias. The models for HGI (r = 0.958; D = 91.71%) and ignition temperature (r = 0.928; D = 86.21%) demonstrated high accuracy and can be applied in technological calculations of PCI blend composition. The model for FSI showed a moderate level of correlation (r = 0.577), which is attributed to the limited range and discrete nature of the parameter; however, its accuracy corresponds to the metrological capabilities of the determination method. The obtained results confirm the feasibility of applying the developed models for predicting the properties of coal blends under industrial conditions.

Keywords: coal, coal blends, statistical assessment, pulverized coal injection (PCI), additivity, mathematical models.

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