Study of laser pyrolysis of coals with analysis of gaseous products

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The paper presents the results of a study of the action of pulsed laser radiation (1064 nm, 120 μs, 10 Hz, 1.5 J/cm^2) on coal samples in an argon medium. The objects of study were coals of the Kuznetsk coal basin grades D, OS, SS, T and A (Russian coal classification system). We used pelleted samples made from coal particles with a size of < 63 μm, the distribution maximum was at a particle size of ~ 20 μm.

The products of laser pyrolysis of pelletized coal samples in argon medium are H_2, CH_4, H_2O, CO и CO_2 molecules. The dependences of the composition of gaseous products of pyrolysis of coal samples on their technical and genetic characteristics (the yield of volatile matter, the degree of coalification, the atomic ratio H/C and O/C, the aromaticity index) have been established.

Data on the yield of combustible gases per unit mass of reacted coal samples were obtained, and the fraction of reacted coal samples were determined. It is shown that with an increase in the chemical maturity of coals, the yield of combustible gases per unit mass of the reacted sample increases, while the proportion of the reacted sample, on the contrary, decreases.

During laser pyrolysis of pelleted coal samples in an argon medium, correlations are observed between the yield of combustible gases per unit mass of the reacted sample, the fraction of the reacted sample, and the technical, genetic characteristics of coals (the yield of volatile matter, the degree of coalification, the atomic ratio H/C and O/C, aromatic index). For the yield of combustible gases per unit mass of the reacted coal sample, the strongest correlation was found for the aromaticity index. For the fraction of the reacted coal sample, the strongest correlation was found for the yield of volatile matter.

In addition, it is shown that the volume fraction of combustible gases (H_2, CH_4, CO) in the mixture of gaseous products of laser pyrolysis of coals increases with increasing chemical maturity of coals.

Let us note that the formation of coal tar was detected during laser pyrolysis of pelleted samples of coal grades D, OS, SS, and T in argon medium.