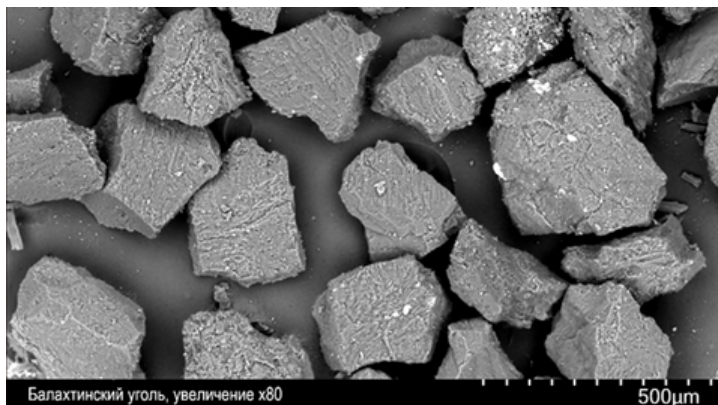


Multi-Component Fuel Mixtures Better Than Coal

Scientists from Siberian Federal University and Tomsk Polytechnic University have conducted a study of the combustion processes of two- and three-component solid fuel mixtures based on carbonated coal obtained during partial gasification of Balakhta coal and brown coals of the Kansk-Achinsk basin. This scientific field is of high demand due to contributing to resource saving and ecological safety.



The main goal of the study was comparing the combustion characteristics of two- and three-component solid-fuel mixtures based on carbonated coal and two brown coals with different technical and elemental composition. To achieve this goal, scientists conducted a thermogravimetric analysis in an air flow at a heating rate of 20°C/min. Having analyzed the curves demonstrating the mass loss and the rate of mass change (TG / DTG) the scientists identified important characteristics of the fuel mixtures, such as the temperature of the heating source at which ignition occurs; temperature during combustion and the combustion index. Endothermic and exothermic effects (i.e. how much heat was absorbed and released by the fuel during combustion) were identified from differential scanning calorimetry curves.

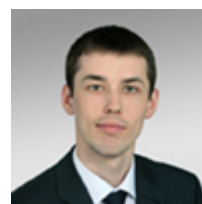
As a result, scientists established a linear dependence of the combustion index on two- and three-component fuel combustion heat for the first time. The increase in combustion heat of the fuel mixture by more than 7% affects the reduction in the combustion index up to 2 times. The maximum proportion of carbonated coal added to two- and three-component fuel mixtures is no more than 20–30%. This proportion should not be increased so as not to reduce the combustion characteristics of solid fuel mixtures.

The scientists noted that three-component fuel mixtures are especially promising for practical application due to the positive effect on increasing the energy characteristics of the mixture and reducing the induction period, that occurs when adding two components of highly reactive and high-calorie fuel to the base fuel.

Andrey Zhuikov, head of the Educational and Scientific Laboratory, SibFU Department of Heat Engineering and Fluid and Gas Dynamics: *“The involvement of high-calorie carbonized coals in the fuel and energy complex is a promising direction in thermal engineering. However, combusting pure carbonated coal is economically impractical, therefore it is proposed to add no more than 30% of carbonated coal to brown coal for increasing the calorific value of the fuel mixture.”.*



Dmitriy Gluschkov, co-author of the study, associate professor of TPU Research School of High-Energy Physics also noted that practical application of multi-component fuel mixtures for energy generation allows us to solve several problems at once. *“The achievement of positive energy, environmental and economic effects in comparison with currently widely used solid fuels, requires conducting a detailed research on the combustion processes of solid fuel mixtures.”*



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