

Thermal decomposition of sulfur brown coal at different heating rates

Vladimir Kislov, Maxim Tsvetkov, Yulia Tsvetkova, Marina Salganskaya, Andrey Zaichenko, Eugeny Salgansky, Dmitry Podlesniy

Federal Research Center of Problems of Chemical Physics and Medicinal Chemistry RAS,
Semenov ave., 1, Chernogolovka, Russia, 142432

vmkislov@icp.ac.ru

Despite the fact that coal is one of the "dirtiest" fuels, its use in energy and other industries is gradually increasing [1]. In this regard, it becomes very relevant to search for methods of using coal with minimal damage to the environment.

The purpose of the work is to study the sulfur content in solid products under various modes of heat treatment of sulfurous brown coals. The object of the study was the sulfurous brown coal of the Moscow basin, characterized by a predominance of sulfide sulfur in the form of pyrite (FeS_2), chalcopyrite (CuFeS_2) and marcasite (polysulfide of iron, FeS_2).

The experiments were carried out in a muffle electric furnace. Coal particles weighing 25.0 g were suspended in the furnace, the particle size was 1.5, 2.5 and 5.0 mm. Rapid heating was carried out in the temperature range from 500 to 1200°C with a holding time at a given temperature for 15 seconds. With gradual heating, the samples were simultaneously placed inside the furnace and heated from room temperature to 1200°C. When the required temperature is achieved, one of the samples was removed from the furnace, cooled and weighed, then given for elemental analysis.

Experiments are shown that at rapid heating of coal, dehydration and carbonation processes mainly occur. The sulfur contained in the coal remains almost completely in the solid residue.

At the gradual heating from 300 to 900°C, pyrolysis processes are mainly carried out, and intensive release of volatiles are occurred. At a temperature of 900°C, carbonation is almost completely completed. In the temperature range from 900 to 1200°C, the oxidation of the coke residue occurs at a constant rate. The sulfur content in the solid residue is determined by the temperature and intensity of oxidation of the organic mass of coal. The best temperature conditions for the thermal processing of this coal is the range of 1000-1200°C, this regime makes possible to burn the carbon contained in the coal, but does not lead to complete combustion of the sulfur-containing compounds contained in the one.

The measurements of the elemental composition of the materials used and the combustion products were carried out using the equipment of FRC PCP MC RAS.

This work funded by the Ministry of Science and Higher Education of Russian Federation, theme #FFSG-2024-0016.

References

1. Russia's Energy strategy for the period up to 2035 / <https://minenergo.gov.ru/node/18038>, 09.06.2020.