The dynamics of sulfur compounds release investigation at combustion and its absorption by the calcium-based additives

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Currently, coal is still one of the main types of fuel. The significant disadvantages of coal as a fuel is the sulfur presence, mainly in the form of sulfides: pyrite (FeS_2), as well as chalcopyrite ($CuFeS_2$) and marcasite (iron polysulfide, FeS_2). When such coals are burning, hydrogen sulfide, sulfur dioxide and carbon dioxide are formed, and harm the environment when they entering in the gas phase. Taking into account the volume of coal processed annually, it is necessary to take measures to reduce emissions of sulfur-containing gases.

The aim of the work is to determine the ability of marble in direct contact with sulfurous brown coal to absorb sulfur compounds released as coal burns out, as well as the residual sulfur content in the continuation of coal combustion, and the dynamics of the release of sulfur compounds into the gas phase in processes of combustion are studied.

Eight cuvettes were simultaneously loaded into the furnace, at the bottom of which particles of Tula coal were filled in, on top of which a layer of marble particles was poured (in a mass ratio of 1:1). The particle mass of both coal and marble was the same, and was 10.0 g. The average particle size of coal and marble was 5 mm.

The studied samples were heated from room temperature to 1200^{o}C. During heating, when the temperature reached 500°C, the first cuvette was removed, and then, after heating the furnace, the next cuvette was removed for every 100°C. After cooling, the particles of calcined marble and unburned coal were separated from each other and given for analysis.

When particles of sulfurous brown coal and marble particles filled on top of it burn in a cuvette, as the coal burns, the proportion of sulfur contained in it decreases almost linearly, and the proportion of sulfur absorbed by marble and its output into gaseous products increases.

The chemical composition of marble are also have changes with heating and combustion of coal. At temperatures of 500 – 800°C, the decomposition of $CaCO_3$ practically does not occure, sulfur is mainly absorbed as CaS. Active decomposition of $CaCO_3$ begins at temperatures of 800 – 1000°C, and is almost completely completed at 1000 – 1200°C. After burning of loading in layers coal and marble particles in the furnace, the marble was mainly converted into CaO (and some sufficient amount of $CaCO_3$) and CaS.

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.

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