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ANALYSIS OF FEATURES OF COMBUSTION OF ANTHRACITE CALIBRATION AT DIFFERENT ENERGY INSTALLATIONS

АНАЛІЗ ОСОБЛИВОСТЕЙ СПАЛЮВАННЯ АНТРАЦИТОВОГО ШТИБУ НА РІЗНИХ ЕНЕРГЕТИЧНИХ УСТАНОВКАХ

Sheleshey T.V. / Шелешей Т.В.
senior lecturer / ст.викл.
Bednarska I. S. / Беднарська І.С.
assist. / асист.
ORCID: 0000-0002-5558-4467
Меренгер П.П./Merenher P.P.
senior lecturer / ст.викл.
National Technical University of Ukraine
Doroshenko V.V./ Дорошенко В.В
student / студент
Yurchuk V.S/ Юрчук В.С
student / студент
"Igor Sikorsky Kyiv Polytechnic Institute", Kyiv, Politechnichna, 6, 03056
Національний технічний університет України
«Київський політехнічний інститут ім. Ігоря Сікорського», Київ, Політехнічна, 6, 03056

Annotation. *The main task of this research is to determine the emission rate of sulfur dioxide depending on the combustion process used: furnaces with liquid slag removal, solid slag removal, circulating fluidized layer, fixed layer. During the study, sulfur dioxide emissions were calculated. The best setting in terms of environmental friendliness is a circulating fluidized layer, the worst - a fixed layer installation.*

Key words: *harmful emissions, emission index, sulfur dioxide, circulating fluidized layer, combustion technology.*

Introduction. Over the past 20 years, humanity has been seriously concerned about the ecological state of our planet. For decades, we have been depleting our planet of emissions, devastating the Earth's reserves. Energy consumption is associated with all types of human activities: heating homes, cooking, traffic, industry. Combustion of fossil solid and liquid fuels is accompanied by the release of sulfur, carbon dioxide and carbon monoxide, as well as oxides of nitrogen, dust, soot and other pollutants [1].

The main reasons for the negative impact of TPPs are outdated production technology and equipment, use of low-grade fuel, unfavorable structure of industrial production with a high concentration of environmentally hazardous production technologies and lack of proper environmental systems (treatment plants, circulating water supply systems, etc.) and low operation of existing environmental facilities.

One of the most harmful substances that are released into the environment as a result of the combustion of fossil fuels is sulfur dioxide, which is one of the main pollutants in the atmosphere, causing the formation of acid rain. Sulfur dioxide SO_3 is formed during the oxidation of sulfur dioxide. The end product of the reaction is an aerosol or solution of sulfuric acid in rainwater, which oxidizes the soil, exacerbates human respiratory diseases. Pyrometallurgical enterprises of non-ferrous and ferrous metallurgy, as well as the energy industry annually emit tens of millions of tons of

sulfur dioxide. It is proved that for combustion at various power and industrial pulverized coal plants in order to reduce harmful emissions it is recommended to use anthracite [2]. Anthracite differs from other types of coal by low content of moisture, sulfur, volatile substances, high specific heat of combustion. The main advantage of anthracite is that it can be burned in boilers with different combustion processes: furnaces with liquid slag removal, solid slag removal, circulating fluidized layer, fixed layer.

The main text. Consider in more detail the above installations. A fluidized layer is a two- or three-phase system that is created by bringing particles of a solid phase to a suspended state by dynamically influencing them by an upward flow of liquid or gas (air) [3]. A furnace with a fixed layer is a type of fuel combustion that originates from the development of fire by ancient people in the form of a fire. Fuel can be loaded manually, through the door, or mechanically, from the hopper. In furnaces with a fixed layer, the fuel lying freely on the grates is blown from below by air [4]. With liquid slag removal furnaces are of different types. Much more favorable working conditions of a semi-open single-chamber furnace with liquid slag removal. Here the melting zone and the cooling zone are largely separated. In the combustion chamber, the screen pipes are studded and covered with refractory coating. At the top of the furnace are open screen surfaces that provide cooling of the gas and removal. In a two-chamber furnace with liquid slag removal, the combustion chamber with liquid slag and the cooling chamber are separated by slag-separating gratings, which are made of diluted studded screen tubes having a refractory coating.

The main amount of molten slag is captured in the combustion chamber. Additionally, the trapped slag flows to the bottom of the furnace, from where it enters the water bath for granulation through the fly. Up to 70% of all ash is captured in the two-chamber furnace [5].

To determine the most efficient technological method of burning anthracite, among those discussed above, it is necessary to calculate the level of emission of sulfur oxides. Calculations were performed in accordance with [6]. The obtained calculations are listed in table 1.

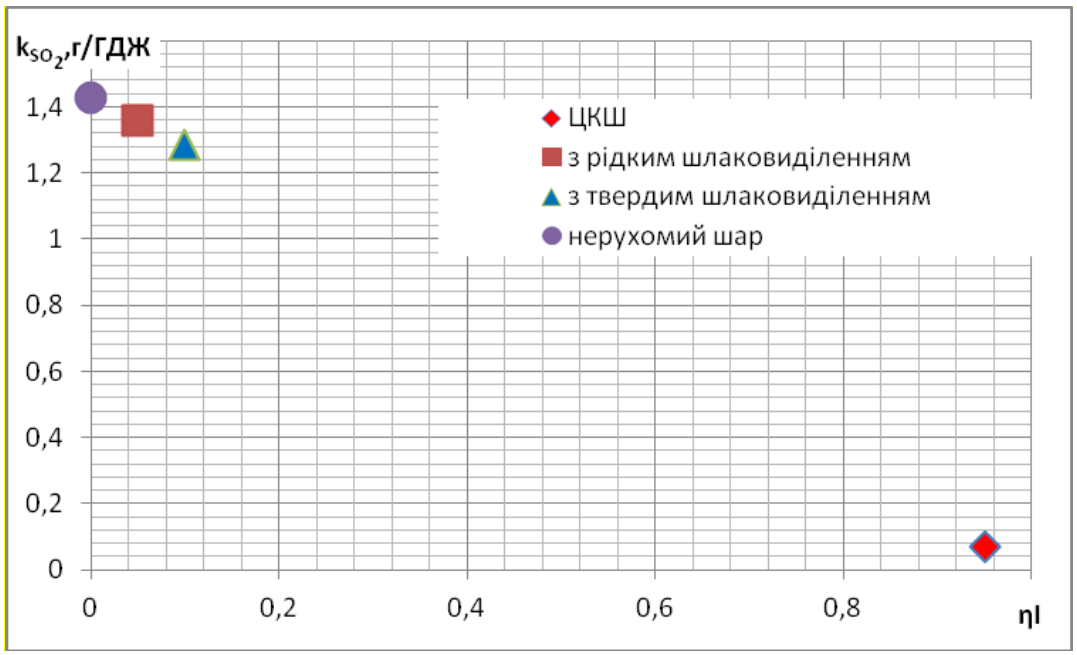
Table 1

The emission index of sulfur oxides when using different technological methods of combustion of anthracite

Installation for burning of anthracite	Nitrogen oxide emission index, g / Gcal
With a circulating fluidized layer	0,071486
With a fixed layer	1,42971
With liquid slag removal	1,358225
With solid slag removal	1,286739

Source: author's development

Figure 1 shows the dependence of the emission of sulfur oxides during the combustion of coal in a circulating fluidized layer, with liquid and solid slag removal during flare combustion and in a fixed layer. The graph shows that the best setting in terms of environmental friendliness is a circulating fluidized layer, the worst - a fixed layer installation.



Source: author's development

Figure 1. Dependence of sulfur oxide emission during anthracite combustion in power plants with different combustion technologies

Conclusions.

The following anthracite-type combustion plants in order to reduce the level of sulfur oxides emission are considered: boilers with circulating fluidized layer and fixed layer, as well as boiler plants with liquid slag removal and solid slag removal. A comparative analysis of the level of sulfur oxides emission during the combustion of anthracite was performed using different technological methods. It is established that the most optimal installation from the point of view of environmental friendliness is the circulating fluidized bed, the worst - the installation with a fixed layer.

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Анотація. *Основним завданням даного дослідження є визначення показника емісії сірчистого ангідриду в залежності від використаного технологічного процесу спалювання: топки з рідким шлаковидаленням, твердим шлаковидаленням, циркулюючий киплячий шар, нерухомий шар. В ході дослідження розраховані показники емісії сірчистого ангідриду. найоптимальнішою уставкою з точки зору екологічності є циркулюючий киплячий шар, найгіршою – установка з нерухомим шаром*

Ключові слова: *шкідливі викиди, показник емісії, сірчистий ангідрид, циркулюючий киплячий шар, технологія спалювання.*

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