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ADVANTAGES AND METHODS OF COMBUSTION OF SOLID FUELS IN A FINELY DISPERSED STATE

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Abstract: In modern energy systems, the combustion process of solid fuels in a highly dispersed state is considered one of the key technological challenges. This article discusses the development of a burner design that ensures efficient combustion of solid fuels in a finely dispersed state.
Keywords: solid fuel, burner, mechanochemical method, pneumatic dispersion method, ultrasonic technology.

For the combustion of solid fuels in a highly dispersed state, they must be ground into fine particles. The following methods are used for this purpose:

The mechanochemical method involves breaking solid fuels into fine particles and chemically modifying them to improve their combustion properties. This method combines physical-mechanical effects and chemical reactions.

For this purpose, solid fuels are ground using special mills, crushers, or ultra-fine mechanical devices. Chemical reagents or catalysts are added to the fuel to modify its composition and combustion characteristics. Stabilizers are used to ensure the modified particles remain stable under specific conditions.

By using this method, the expansion of the combustion surface increases energy efficiency. It allows for the control of combustion rate and temperature. Additionally, it helps reduce harmful gas emissions into the atmosphere and enhances the porosity and reactivity of the solid fuel phase.

The mechanochemical method of dispersing solid fuels improves their physical and chemical properties. This approach makes fuels more efficient and environmentally friendly. In the future, further development of this technology will contribute to increased energy efficiency and reduced environmental impact.

Lignite coal crushed to various fractions from the Angren mine.

The dispersion of solid fuels is an important technological process to increase their surface area and improve the combustion process. The pneumatic method is highly efficient in this process, ensuring the fine dispersion of fuel particles using the kinetic energy of air.

The pneumatic dispersion method is the process of separating and breaking fuel particles into smaller fragments using a gas stream or compressed air. This method employs specialized equipment and aerodynamic systems.

In this process, solid fuel is crushed and separated into the required particle sizes. The interaction between compressed air or another gas stream and the particles increases. Using turbulent flow, the fuel particles are brought into a fine dispersed state. The dispersed fuel then mixes with the gas and is directed into the combustion process.

This method accelerates the combustion process and increases the level of heat generation. It ensures complete fuel combustion and reduces emissions. It allows for maximum fuel utilization and reduces energy consumption. Additionally, it enables the use of various types of solid fuels.

The pneumatic dispersion method is used in various industries, including thermal power plants, metallurgy, the chemical industry, and cement production processes. This technology helps improve fuel efficiency and ensures energy savings.

The pneumatic method of solid fuel dispersion is an important technological process in the energy and industrial sectors. This method is highly efficient, environmentally friendly, and economically beneficial. In the future, further improvements in this method will contribute to increasing the efficiency of energy resource utilization.

In recent years, ultrasonic technology has been widely used as an effective method for dispersing solid fuels. Ultrasonic waves are high-frequency mechanical vibrations that act on liquids or solid materials, breaking them into fine particles. This process involves the phenomenon of cavitation, where microbubbles form in the liquid medium and collapse under pressure, releasing intense localized energy. This energy enables the grinding of solid fuels and ensures a uniform dispersion state.

In the ultrasonic dispersion process, solid fuel particles are pre-dried and prepared to the required size. The solid fuel is processed in a specialized liquid medium (such as water, solvents, or stabilizers) using ultrasonic waves. The fine particles generated by ultrasound are filtered and stabilized to ensure uniform distribution. The final dispersion results are evaluated through microscopic examination, particle size analysis, and combustion efficiency tests.

The use of the ultrasonic dispersion method allows particles to be ground down to the micron and nanometer range. It ensures uniform particle distribution. The final product can be obtained without additional reagents. Due to improved fuel efficiency, harmful emissions are reduced.

The ultrasonic dispersion method is one of the promising technologies for grinding solid fuels and improving their combustion efficiency. Its industrial application helps reduce fuel consumption and improve the environmental conditions. In the future, further advancements in ultrasonic technology can lead to even greater results.

When burning highly dispersed fuels, we use a broner device. A broner is a device designed to create optimal conditions for burning highly dispersed solid fuels. It ensures uniform fuel distribution and maximizes energy release during combustion. The broner also optimally directs the gases released from the fuel and reduces the amount of harmful gases emitted into the environment.

The following tasks were carried out to develop the broner system.

The properties of existing fuel types and their combustion processes were studied. The initial design of the broner was developed, and its parameters were determined. The broner prototype was tested, and the results were analyzed. Based on the experimental results, the broner design was improved.

As a result of the research, the following proposals were developed to improve the efficiency of the broner system.

Accelerating the combustion process by preheating the fuel.

The efficiency of the Broner system depends on the complete and rapid combustion of the fuel. Preheating the fuel accelerates the combustion process, improves engine efficiency, and reduces fuel consumption. The study examines fuel preheating and its impact on the combustion process.

In engines, maintaining the optimal temperature of the fuel-air mixture is crucial. Preheating the fuel offers several advantages. It accelerates the fuel evaporation process and ensures better distribution in the combustion chamber. Complete fuel combustion prevents waste. Engine efficiency improves, maintaining high power output. As a result of complete combustion, harmful gas emissions are reduced.

Fuel can be preheated using various methods. These include preheating the fuel with electrical energy, using heat from the engine's cooling system, and utilizing hot exhaust gases for fuel preheating.

Fuel preheating is one of the essential methods for improving engine efficiency, accelerating the combustion process, and reducing fuel consumption. This technology has a positive impact on fuel savings and environmental cleanliness. Therefore, applying this method in automotive engines and industrial burner systems is considered appropriate.

Activating the combustion reaction using various catalysts.

Enhancing the efficiency of these systems requires accelerating the combustion process and ensuring complete combustion. In this regard, the use of various catalysts helps to increase the activity of the combustion reaction.

Catalysts improve combustion efficiency by accelerating chemical reactions. They enable combustion reactions to occur with lower energy consumption, ensuring the complete burning of fuel. This, in turn, reduces fuel consumption, minimizes harmful emissions, and extends the operational lifespan of the system.

There are several types of catalysts:

Among metal catalysts, precious metals such as platinum, palladium, and rhodium are considered the most effective. These metals accelerate oxidation reactions occurring in the gas phase and help neutralize toxic substances.

Ceramic catalysts are suitable for operating under high-temperature and high-pressure conditions. They ensure stability during the combustion process and contribute to improving energy efficiency.

Catalysts developed using nanotechnology expand the reaction surface, further accelerating the combustion process. For example, nanoscale platinum and palladium coatings significantly enhance catalytic processes.Broner tizimlarida katalizatorlar turli yo‘nalishlarda qo‘llaniladi.

1. Enhancing reaction efficiency in combustion chambers.
2. Reducing harmful gases in exhaust gas purification systems.
3. Improving economic efficiency by optimizing fuel consumption.

The use of various catalysts is an important strategy for improving the efficiency of armor systems and reducing environmentally harmful emissions. With scientific and technological advancements, the possibility of creating more efficient and environmentally safe armor systems through innovative catalysts is increasing.

Implementation of modern automated control systems

The introduction of modern automated control systems ensures precise system operation, cost reduction, and minimization of human factor influence. The significance of automated control systems in enhancing the efficiency of armor systems and the methods of their implementation have been analyzed.

Modern software solutions enable real-time data processing in armor systems. This creates opportunities for rapid decision-making and optimizing service processes.

Automated systems help reduce errors caused by human factors. Additionally, modern encryption technologies can be used to ensure information security.

Through automated control systems, resources can be used efficiently, and unnecessary costs can be reduced. This, in turn, enhances the overall efficiency of the armor system.Zamonaviy avtomatlashtirilgan boshqaruv tizimlarini joriy etishda usullardan foydalanish mumkin.

1. Utilization of cloud technologies - cloud technologies enable secure data storage and fast access, contributing to the increased efficiency of the armor system.
2. Implementation of artificial intelligence and analytical systems - Artificial intelligence algorithms can analyze user behavior and make the armor system more adaptive and flexible.
3. Development of mobile applications and web platforms - Creating user-friendly interfaces and automating the booking process can enhance the level of service provided.

The implementation of modern automated control systems in armor systems can enhance efficiency, improve service quality, and ensure the effective use of resources. The integration of these technologies should be carried out step by step and adapted to meet the specific needs of the system. Thus, the adoption of modern control systems ensures the future success of armor systems.

Conclusion. The development of an armor system that ensures the efficient combustion of solid fuels in a highly dispersed state is of great significance for the energy and industrial sectors. This article highlights the key stages of designing an armor system, ways to enhance its efficiency, and its technological advantages. Future research on further development and improvement of armor systems remains crucial.

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