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В сборник вошли доклады студентов, магистрантов, докторантов и молодых ученых по актуальным вопросам естественно-технических и гуманитарных наук.

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Подсекция 12.2
ТРАНСПОРТ, ТРАНСПОРТНАЯ ТЕХНИКА И ТЕХНОЛОГИЯ

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NEW DESIGN OF EXHAUST GAS PURIFICATION CATALYST FOR AUTOMOBILES

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Annotation. The article presents a catalytic converter of exhaust gases, its purpose is to oxidize harmful compounds. The design of the catalyst is simple, but the content of precious metals does not affect the cost of the catalyst in the best way.

The author put forward the idea of developing and creating a mock-up of a device for cleaning harmful emissions based on a catalytic converter that can accelerate oxidative and reducing processes when emissions containing sulfur oxides, nitrogen, carbon monoxide pass through them. At the same time, these pollutants are converted by them to harmless substances – N2, CO2, H2O, S, etc.

The developed device combines two methods of cleaning gas emissions - catalytic, achieved due to the presence of various heavy metal ions that can accelerate the oxidation/reduction of toxic gases to harmless substances, as well as sorption, due to the high absorption properties of minerals. Absorption purification plays an important role, as it delays soot and hydrocarbons, which may reduce the efficiency of the catalytic process, in addition, the gas emission is cleaned more completely.

Key words: catalyst, exhaust gases, neutralizer.

The uniqueness of the developed products lies in the technology of creating a device for cleaning harmful emissions based on a catalytic converter, which involves the use of natural

materials, aluminosilicate minerals and shungite, impregnated (impregnated) solutions of galvanic waste containing heavy metal oxides (Ni, Fe, Pb, Cd, etc.). These ions are able to accelerate oxidative and reducing processes during the passage through them of emissions containing oxides of sulfur, nitrogen, carbon monoxide. These pollutants are converted by them to harmless substances - N2, CO2, H2O, S, etc.

Aluminosilicate minerals differ in the content of ferrous and trivalent iron, magnesium, calcium, potassium, phosphorus, as well as trace elements - copper, cobalt, chromium, molybdenum, beryllium, barium, cadmium, etc. All of them are in the easily recoverable form of replaceable cations, which are replaced by elements in excess in the environment. This circumstance, as well as the layered structure, explains their high sorption properties in relation to radioactive elements, heavy metals, petroleum products and other pollutants of a man-made nature, in particular, and gases polluting the atmosphere [1, 2].

Another component is the natural mineral shungite. Shungite occupies an intermediate place between amorphous (soot, anthracite, etc.) and crystalline (diamond, graphite) forms of carbon, with characteristic features of both substances. At the same time, fullerenes have been found in shungite, representing a completely new type of molecular form of carbon. Fullerenes have a number of unusual specific physical and chemical properties. Shungite contains almost all the elements of the periodic table of Mendeleev. The specific structural features of shungite determine its unique technological properties and a wide range of possible applications [4].

Thus, the developed device combines two methods of cleaning gas emissions - catalytic, achieved due to the presence of various heavy metal ions that can accelerate the oxidation/reduction of toxic gases to harmless substances, as well as sorption, due to the high absorption properties of minerals. Absorption purification plays an important role, as it delays soot and hydrocarbons, which may reduce the efficiency of the catalytic process, in addition, the gas emission is cleaned more completely [3,4,5].

During the combustion of the working mixture, a number of combustion products harmful to human health are formed, in particular, carbon monoxide (CO), various hydrocarbons (CH) and nitrogen oxides (NO). Although these substances make up only 1% of the total exhaust (the rest is nitrogen, carbon dioxide and water vapor), they are very harmful and require neutralization. There are several ways to deal with harmful exhaust emissions – for example, impoverishment of the mixture on which the engine is running or exhaust recirculation – but none of them can be compared in efficiency with a catalytic converter [5,6].

The proposed device should look so as to fit seamlessly into the exhaust system of cars, as, for example, shown in Figures 1 and 2.

Figure 1 Catalyst device

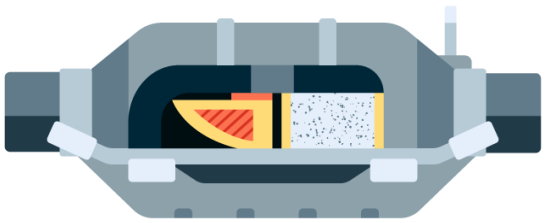

Figure 2 Proposed device

Inside the stainless steel case there is a ceramic or metal "brick" having a honeycomb structure. This monolith has a huge surface area, and all of it is covered with the thinnest layer of a special alloy – actually a catalyst containing platinum, rhodium and palladium. It is these precious metals that are responsible for the wonderful properties of the catalyst, they also determine its high cost. Exhaust gases "wash" the surface of the monolith, and when the temperature reaches a "critical" value of 270 ° C, a catalytic reaction begins. Carbon monoxide turns into dioxide (carbon dioxide), hydrocarbons turn into water and again carbon dioxide, and nitrogen oxides turn into water and nitrogen. All this is less harmful to the environment [3,4].

Catalytic converters are able to reduce exhaust toxicity quite effectively, while they do not affect fuel consumption and engine power. In the presence of a catalyst, the back pressure of the exhaust increases slightly, from which the engine loses 2-3 hp, but this is practically the entire "fee" for cleaning the exhaust. However, installing a catalytic converter is not an ideal solution. Theoretically, it should serve indefinitely, since the aforementioned precious metals serve only as a catalyst, which, as is known, is not consumed during a chemical reaction. In practice, the life of the catalyst has its limit [5,6].

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