ISSN 2518-170X (Online),
ISSN 2224-5278 (Print)

ҚАЗАҚСТАН РЕСПУБЛИКАСЫ
ҰЛТТЫҚ ҒЫЛЫМ АКАДЕМИЯСЫНЫҢ

Х А Б А Р Л А Р Ы

ИЗВЕСТИЯ

НАЦИОНАЛЬНОЙ АКАДЕМИИ НАУК
РЕСПУБЛИКИ КАЗАХСТАН

N E W S

OF THE ACADEMY OF SCIENCES
OF THE REPUBLIC OF KAZAKHSTAN

ГЕОЛОГИЯ ЖӘНЕ ТЕХНИКАЛЫҚ ҒЫЛЫМДАР СЕРИЯСЫ

♦

СЕРИЯ ГЕОЛОГИИ И ТЕХНИЧЕСКИХ НАУК

♦

SERIES OF GEOLOGY AND TECHNICAL SCIENCES

4 (424)

ШІЛДЕ – ТАМЫЗ 2017 ж.
ИЮЛЬ – АВГУСТ 2017 г.
JULY – AUGUST 2017

ЖУРНАЛ 1940 ЖЫЛДАН ШЫҒА БАСТАҒАН
ЖУРНАЛ ИЗДАЕТСЯ С 1940 г.
THE JOURNAL WAS FOUNDED IN 1940.

ЖЫЛЫНА 6 РЕТ ШЫҒАДЫ
ВЫХОДИТ 6 РАЗ В ГОД
PUBLISHED 6 TIMES A YEAR

АЛМАТЫ, ҚР ҰҒА
АЛМАТЫ, НАН РК
ALMATY, NAS RK

«ҚР ҰҒА Хабарлары. Геология мен техникалық ғылымдар сериясы».
ISSN 2518-170X (Online),
ISSN 2224-5278 (Print)
Меншіктенуші: «Қазақстан Республикасының Ұлттық ғылым академиясы» РҚБ (Алматы қ.).
Қазақстан республикасының Мәдениет пен ақпарат министрлігінің Ақпарат және мұрағат комитетінде 30.04.2010 ж. берілген **№10892-Ж** мерзімдік басылым тіркеуіне қойылу туралы куәлік.

Мерзімділігі: жылына 6 рет.
Тиражы: 300 дана.

Редакцияның мекенжайы: 050010, Алматы қ., Шевченко көш., 28, 219 бөл., 220, тел.: 272-13-19, 272-13-18, http://nauka-nanrk.kz /geology-technical.kz

Редакцияның мекенжайы: Қазақстан, 050010, Алматы қ., Қабанбай батыра көш., 69а.
Қ. И. Сәтбаев атындағы геология ғылымдар институты, 334 бөлме. Тел.: 291-59-38.

Типографияның мекенжайы: «Аруна» ЖК, Алматы қ., Муратбаева көш., 75.

«Известия НАН РК. Серия геологии и технических наук».
ISSN 2518-170X (Online),
ISSN 2224-5278 (Print)
Собственник: Республиканское общественное объединение «Национальная академия наук Республики Казахстан (г. Алматы)
Свидетельство о постановке на учет периодического печатного издания в Комитете информации и архивов Министерства культуры и информации Республики Казахстан **№10892-Ж,** выданное 30.04.2010 г.

Периодичность: 6 раз в год
Тираж: 300 экземпляров

Адрес редакции: 050010, г. Алматы, ул. Шевченко, 28, ком. 219, 220, тел.: 272-13-19, 272-13-18, http://nauka-nanrk.kz /geology-technical.kz

---

Адрес редакции: Казахстан, 050010, г. Алматы, ул. Кабанбай батыра, 69а.
Институт геологических наук им. К. И. Сатпаева, комната 334. Тел.: 291-59-38.

Адрес типографии: ИП «Аруна», г. Алматы, ул. Муратбаева, 75

News of the National Academy of Sciences of the Republic of Kazakhstan. Series of geology and technology sciences.
ISSN 2518-170X (Online),
ISSN 2224-5278 (Print)
Owner: RPA "National Academy of Sciences of the Republic of Kazakhstan" (Almaty)
The certificate of registration of a periodic printed publication in the Committee of information and archives of the Ministry of culture and information of the Republic of Kazakhstan N 10892-Ж, issued 30.04.2010

Periodicity: 6 times a year
Circulation: 300 copies

Editorial address: 28, Shevchenko str., of. 219, 220, Almaty, 050010, tel. 272-13-19, 272-13-18,
http://nauka-nanrk.kz/geology-technical.kz

Editorial address: Institute of Geological Sciences named after K.I. Satpayev
69a, Kabanbai batyr str., of. 334, Almaty, 050010, Kazakhstan, tel.: 291-59-38.

Address of printing house: ST "Aruna", 75, Muratbayev str, Almaty

N E W S
OF THE NATIONAL ACADEMY OF SCIENCES OF THE REPUBLIC OF KAZAKHSTAN
SERIES OF GEOLOGY AND TECHNICAL SCIENCES
ISSN 2224-5278
Volume 4, Number 424 (2017), 142 – 147

UDC621.436.038

B. N. Azamatov[1], K. A. Ozhikenov[2], Zh. K. Azamatova[1]

[1]East Kazakhstan state technical university, named after D. Serikbaev, Ust'-Kamenogorsk, Kazakhstan,
[2]Kazakh national research technical university named after K. I. Satpayev, Almaty, Kazakhstan.
E-mail: Azamatovy@mail.ru, kas_ozhiken@mail.ru, Zhanerkeaz@mail.ru

ASSESSMENT OF THE EFFECTIVENESS OF THE USE OF PALLADIUM IN CATALYTIC SHS-UNITS FOR DIESEL ENGINES

Abstract. This paper considers the questions of the purification of exhaust gases of diesel engines from nitrogen oxides, carbon monoxide CO, hydrocarbons CxHy and particulate matter PM, on the catalysts of the porous permeable materials produced by SHS synthesis.

Experimental study on the determination of the effectiveness of catalytic conversion of exhaust gases on the SHS-materials was carried out under the following conditions: the identity of the average diameter, pore size, porosity and pore tortuosity. This was achieved by the fact that the basic structure of the charge contained: alloy steel - 47.5%; chromium oxide - 18%; chromium - 5%; nickel - 4.9%; aluminum - 12%; titanium - 11.5 ... 11.6% and up to 1% by weight of various catalysts.

A comparison of the effectiveness of gas cleaning from particulate matter in the porous SHS-units based on Fe-Al with the same characteristics resulted in quality improvement up to 18-20% using palladium Pd as a part of the material.

Next, the procedure aimed in the assessment of the hazardous diesel emissions on such indicators as$q_{as\ NOx}$,$q_{as\ CO}$, $q_{as\ CH}$, $q_{as\ PM}$, the results of which are summarized in Table 1. Here, the estimation of anthropogenic impact values for the same conditions in the case ofEURO 4 and EURO 5emission standards, actual emissions without gas neutralization, and actual emissions with gas neutralization in the presence of porous permeable SHS-units containing palladium Pd.

Keywords: catalyst, self-propagating high temperature synthesis (SHS), exhaust gases.

Introduction. The use of palladium Pd in the systems of exhaust gas cleaning at the plants and in the internal combustion engines has been sufficiently studied by researchers. However, the effectiveness of Pd in the composition of the materials obtained by SHS-technology was never investigated. This can be explained both by the high cost of Pd on world markets and a decrease in production volume observed in the world. At the same time, the use of Pdas part of SHS-materials for catalyst units of the catalytic converters for exhaust gas is of interest due to covering a wide range of effective cleaning of the gases from 450 ... 550K to 825 ... 850K with simultaneously cleaning from nitrogen oxides NOx, carbon monoxide CO, hydrocarbons CxHy.

Development of new materials for catalytic converters is connected primarily to the fact that there is a significant deterioration of the catalysts in the process of cleaning gases from the surfaces of the carriers. This is especially true for the materials on the surface of which the catalysts are covered by electrolytic deposition and impregnation, followed by drying [1].

Using of advanced SHS-technology provides durablecatalysts resistant to the entrainment of gas supplies(Figure 1).

Researchmethodology. Experimental studies were carried out on the engine of KaMAZ-740 (8Ch 12/12). Recording the external high-speed characteristics were made in speed range of 1400...2600 min-1, and the load characteristics at 2600 min-1 with a pilot plant to assess the effectiveness of treatment of the exhaust gas of diesel engine in porous permeable SHS-catalyst block with all the measurements provided by GOST 14846-81 [2], GOST R 41.49-99 [3], GOST R 41.24-99 [4], GOST R 41.83-99 [5] while working with L-0.2-40 fuel according to GOST 305-82 [5].

a) filter

в) catalytic converter assembly

Figure 1 – The design of the filter

The duration of the measurement of fuel consumption was not less than 30 seconds. The measurements of opacity, toxicity, temperature and pressure of the exhaust gas were made at least six times for each of the modes using similar devices through the distribution column.

The test program included characterization of diesel engines by test cycle of 13-modes for determining the valuation of specific emissions of nitrogen oxides NOx, carbon monoxide CO, hydrocarbons CxHy and particulate matter PM. This article describes the tests only on nitrogen oxides NOx emissions.

Emissions of harmful substances along with exhaust gases were determined in accordance with GOST R 41.83-99. Exhaust gas opacity and particulate matter emissions were determined in accordance with GOST R 41.24-99.

At the beginning and at the end of the test program, external speed and load test characteristics were determined, as well as specifications for the 13-mode test cycle.

Experimental study on the determination of the effectiveness of catalytic conversion of exhaust gases on the SHS-materials was carried out under the following conditions: the identity of the average diameter, pore size, porosity and pore tortuosity. This was achieved by the fact that the basic structure of the charge contained: alloy steel - 47.5%; chromium oxide - 18%; chromium - 5%; nickel - 4.9%; aluminum - 12%; titanium - 11.5 ... 11.6% and up to 1% by weight of various catalysts.

The study was conducted in a pilot plant with 8Ch12/12 diesel in the test-bench, equipped in accordance with GOST 21393-75 and GOST 41.49-99 on the fuel according to GOST 308-82 L-0,2-40, MTM-16p oil.

Tests were carried out on the loading characteristics at 2600 min^{-1} and the outside speed at 1400 ... 2600 min^{-1} at ambient temperature T_0 = 300 ... 303K, atmospheric pressure P_0 = 749-752 mm of Hg col., humidity W_0 = 72 ... 79%.

The porosity of the SHS-materials of catalytic units was P = 0.47 ... 0.49; pore tortuosity ξ_i = 1.38 ... 1.40; the volume of the porous mass was 2.13×10^{-3} m^3; relative area of filter surface for the nominal power regime $F_{fm} = 1.64 \times 10^{-4}$ $(m/h)^2$.

The pilot plant with SHS-catalytic converter was mounted back to back with one of the exhaust manifold of a diesel engine, so there is no need to preheat the exhaust gases on the load conditions above 50%, where there are higher levels of emissions.

Results. Comparative tests showed that on the catalytic SHS-materials with palladium Pd content of about 0.3% by weight at the loading characteristic at 2600 min^{-1} for effective pressure values of 0,35..0,55..0,78MPa emissions of nitrogen oxides NOx in the exhaust gases are reduced to 15..60..65% respectively (Figure 2).

Low NOx removal efficiency at low load conditions can be explained by the fact that the exhaust gas temperature of 790K, corresponding to the active influence of Pd catalyst on the process of nitrogen oxidesreduction, is shown starting from the values of the average effective pressure P_e = 0.52 MPa (Figure 2). Hereinafter: C_{NOx}, C_{CO}, C_{CxHy}, C_{PM}– content of nitrogen oxides, carbon monoxide, hydrocarbons,

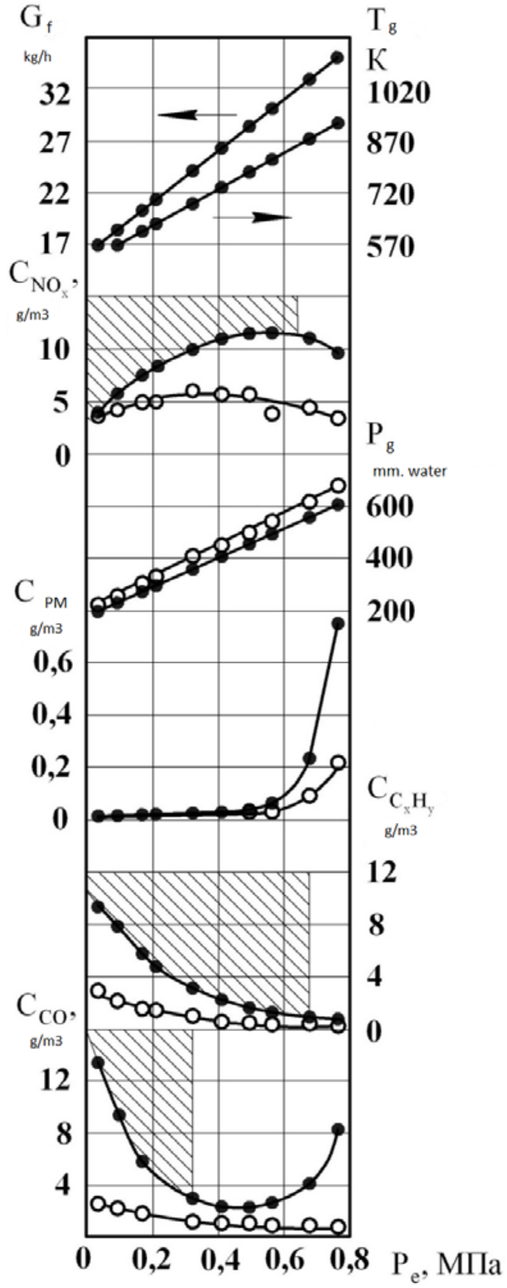

Figure 2 – The effectiveness of cleaning of the exhaust gas of the 8Ch 12/12 diesel engine in SHS-units of the catalyst with the addition of palladium Pd on the loading characteristic at 2600 min^{-1}, where ●–● - without CN; ○–○ - with CN

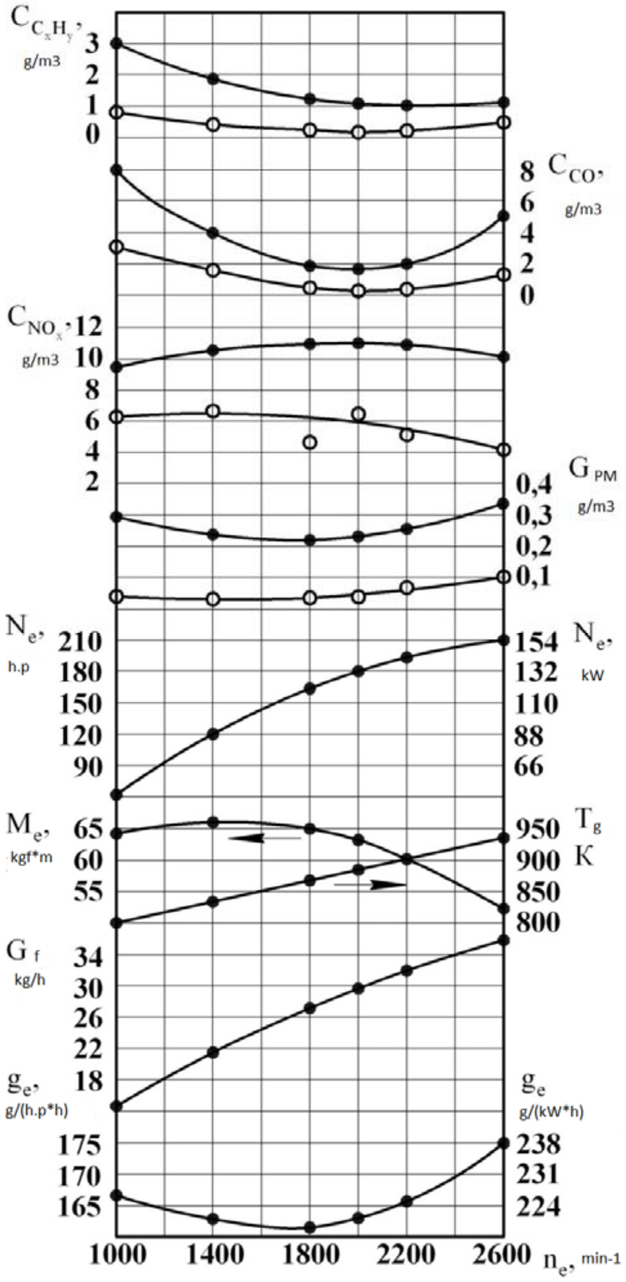

Figure 3 – The effectiveness of cleaning of the exhaustgas of the 8Ch 12/12 dieselengine in SHS-units of the catalyst with the addition of palladium Pd on the loading characteristic, where ●–● - without CN; ○–○ - with CN

particulate matter, respectively, in the exhaust gases, g/m^3; α - coefficient of air excess; T_g - exhaust gas temperature, K; G_a - air flow rate, kg/h; G_f - fuel flow rate, kg/h; g_e– specific effective fuel flow rate, g/(kW·h).

For values of average effective pressure of 0.35 ... 0.55 ... 0,78MPa in the cylinders of diesel emissions of carbon monoxide CO are reduced at the loading characteristic, respectively, to 75 ... 86 ... 92%. Active influence of the Pd catalyst on the processes of CO oxidation begins at the exhaust gas temperature of 520K, and this temperature corresponds to the average effective pressure P_e = 0,10MPa.

At the above mentioned values of average effective pressure at 2600 min^{-1} emissions of hydrocarbons CxHy (total)with the exhaust are reduced to 50 ... 84 ... 83%, respectively. The high efficiency of the exhaust gas purification from the CxHy is because the palladium Pd affects the final oxidation processes of hydrocarbons, starting with the temperature of 450 K, corresponding to the specific effective pressure P_e = 0,4MPa.

Tests carried out on the outside speed at 1400 ... 2600 min^{-1} showed that the efficiency of the Pd catalyst in the reduction of NOx emissions with the exhaust gases at diesel engine speed of n = 1400 ... 1800 ... 2200 ... 2600 min^{-1} was respectively 65 ... 58 ... 50 ... 46%. High efficiency of gas cleaning from NOx is because the exhaust gas temperatures are respectively 820 ... 855 ... 890 ... 920K.

The efficiency of the Pd catalyst in the reduction of carbon monoxide CO emissions at the outside speed of n = 1400 ... 1800 ... 2200 ... 2600 min^{-1} was 95 ... 92 ... 91 ... 86%, respectively. Despite the fact that the range of active influence ofPd on oxidation of the nitrogen lies in the range of 520 ... 820K and the gas temperature at the outside speed varies within 820 ... 920K, the catalyst continues to effect the oxidation processes.

The effectiveness of the catalyst for the reduction of hydrocarbon emissions at the outside speed of n = 1400 ... 1800 ... 2200 ... 2600 min^{-1} is characterized as 84 ... 94 ... 96 ... 91%, respectively. The temperature range of the highest performance of Pd catalyst varies from 450 to 850K, and the purification efficiency reaches 92%.

Considering the results of reducing particulate matter emissions from the exhaust gases, it should be noted that, in principle, all considered porous permeable catalytic materials having the same porosity, permeability, pore tortuosity, wall thickness and the relative area of the filter surface under the same conditions of the diesel engine should also have the same efficiency of gas cleaning from particulate matter.

However, it was found that the efficiency of purification of exhaust gases using various catalysts differs from each other. This can be explained mainly by the fact that in the presence of some catalysts diesel soot ignition temperature decreases and it burns more complete at the porous permeable surfaces of the converters or particulate filter units.

The efficiency of Pd catalyst on the reduction of the particulate matter emissions at the loading characteristic at P_e = 0,35 ... 0,55 ... 0,78MPa and 1900 min^{-1}is 50 ... 88 ... 84%, respectively (Figure 1), at the outside speed of n = 1400 ... 1800 ... 2200 ... 2600 min^{-1}is 91 ... 87 ... 80 ... 83%, respectively (Figure3).

A comparison of the effectiveness of gas cleaning from particulate matter in the porous SHS-units based on Fe-Al with the same characteristics resulted in quality improvement up to 18-20% using palladium Pd as a part of the material.

Next, the procedure aimed in the assessment of the hazardous diesel emissions on such indicators as $q_{as\ NOx}$, $q_{as\ CO}$, $q_{as\ CH}$, $q_{as\ PM}$, the results of which are summarized in Table. Here, the estimation of

Effectiveness of SHS-catalyst units containing palladium Pd on anthropogenic impacts on the environment posed by harmful emissions of 8Ch12/12 diesel

Estimated specific indicators of harmful emissions	The values of assessment indicators and technogenic impact					Exceeding of anthropogenic impact for EURO-3 EURO-4 EURO-5
	Emission levels, g/(kW·h)		The values of the technogenic impact, sf/(km^2·year)			
	Requirements of EURO-4 EURO-5	Actual without CN with CN	without CN	with CN containing Pd	meeting the requirements of EURO-3 EURO-4 EURO-5	
q_{asNOx}	3.50 2.00	8.86 2.64	0.242	0.071	0.135 0.094 0.054	0.526 0.755 1.315
q_{asCO}	1.50 1.50	4.93 1.69				
q_{asCH}	0.46 0.25	1.23 0.33				
$q_{as\ ТЧ}$	0.02 0.02	0.40 0.04				

anthropogenic impact values for the same conditions in the case ofEURO 4 and EURO 5emission standards, actual emissions without gas neutralization, and actual emissions with gas neutralization in the presence of porous permeable SHS-units containing palladiumPd.

For all estimates of anthropogenic impact generated by 8Ch12/12 diesel on the environment, the same conditions were used:

- height of the discharge pipe from the level of the road surface, h_T = 1.00 m;
- dilution ratio on the surface layer, π_d = 2.00;
- average wind speed at a calm, 2.5 m/s;
- average wind speed in the calculations, υ = 10 m/s;
- exhaust gas scattering coefficient, R_p = 88;
- an indicator of the relative dangers of air pollution, characterizing terrain and macroroughnesses, used for urban areas, σ_{apd} = 1.0;
- natural and climatic conditions coefficient, d_{NCC} = 2.00.

When the Euro-3, Euro-4 and Euro-5 standards are maintained, the share of individual exhaust gas components accounted in the values of the anthropogenic impact coefficient is, respectively, for nitrogen oxides - 97.17 ... 97.5 ... 97.12%; for carbon monoxide - 0.43 ... 0.44 ... 0.76%; for hydrocarbons - 1.68 ... 1.85 ... 1.75%; for particulate matter - 0.72 ... 0.21 ... 0.36%.

Conclusion. Analysis of the data indicates that when using Pd as a catalyst in the composition of SHS-material, it can be noted that the diesel engine meets the standards of EURO-3 and EURO-4 on the integrated indicator of technological load. Achieving the EURO-4 standards on the level of technogenic impact can be reached by both the improvement of work processes of a diesel engine and catalytic converter by selection of the catalysts.

This makes it possible to reduce significantly the technogenic impacts on the environment posed by diesel.

REFERENCES

[1] Wieleba Wojciech, Capanidis Dymitry, Woźniak Janusz: Patent. Polska, nr 210216. Sposób wytwarzaniamateriałuna elementy ślizgowemaszynimateriałnaelementyślizgowemaszyn: Opubl. 30.12.2011 / Politechnika Wrocławska, Wrocław.

[2] GOST 14846-81. Automobile engines. Methods of bench tests.

[3] GOST R 41.49-99. Uniform provisions concerning the approval of compression ignition (C.1.) and natural gas (N.G.) engines as well as positive-ignition (P.1.) engines fuelled with liquefied petroleum gas (LPG) and vehicles equipped with C.1 and N.G. engines and P.1. engines fuels with LPG, with regard to the emissions of pollutants by the engine.

[4] GOST R 41.24-99. Uniform provisions concerning: I. The approval of compression ignition (C.I.) engines with regard to the emission of visible pollutants II. The approval of motor vehicles with regard to the installation of C.I. engines of an approved type III. The approval of motor vehicles equipped with C.I. engines with regard to the emission of visible pollutants by the engine IV. The measurement of power of C.I. engine.

[5] GOST R 41.83-99. Uniform provisions concerning the approval of vehicles with regard to the emission of pollutants according to engine fuel requirements.

[6] GOST 305-82. Diesel fuel.Specifications.

[7] Wieleba Wojciech, Capanidis Dymitry, Ziemiański Kazimierz: Polimerowełożyskaślizgowe z tworzyw termoplastycznych: Cz. 1. Materiałyślizgowe / W: Poradniktribologiiitribotechniki. s. 125-131.

[8] Surashev N., Yelemes D., Dudkin M., Kalieva A. The Planetary Vibroexciter with Elliptic Inner Race.Advanced Materials Research Vols. 694-697 (2013)

[9] Melbert A.A. Operating temperatures of catalysts for purification of exhaust gases of diesel engines / A.A. Melbert, Y.G. Maksimeyko, G.V. Medvedev, B.F. Bekbayev // Polzunov almanac. 2009 - 1, #3. - P. 127-132.

Б. Н. Азаматов[1], Қ. А. Ожикенев[2], Ж. Қ. Азаматова[1]

[1]Д. Серікбаев атындағы Шығыс-Қазақстан мемлекеттік техникалық университеті, Өскемен, Қазақстан,
[2]Қ. И. Сәтбаев атындағы қазақ ұлттық техникалық зерттеу университет, Алматы, Қазақстан

ДИЗЕЛЬДІ ҚОЗҒАЛТҚЫШТАР ҮШІН КАТАЛИТИКАЛЫҚ СВС-БЛОКТАРДА ПАЛЛАДИЙДІ ҚОЛДАНУДЫҢ ТИІМДІЛІГІН БАҒАЛАУ

Аннотация. Осы жұмыста дизельді қозғалтқыштардың қалдық газдарын ӨЖС (өздігінен таралатын жоғары температуралық синтез) синтезбен кеуек өткізгіш материалдардан жасалған катализаторларда азот оксидтерінен, көміртек монооксидтерінен СО, көмірсутектілерден СхНужәне катты бөлшектерден тазарту сұрақтары қарастырылған.

СВС- материалдар негізінде қалдық газдарды каталитикалық тазарту тиімділігін анықтау эксперимент-тік зерттеулер келесі шарттарды орындаумен өткізілді: орта диаметрлер біркелкі, тесіктердің өлшемдері бір, тесіктердің кеуектілігі мен иректілігі бір. Оған себеп болған шихтаның негізгі құрамы: легірленген болат - 47,5%; хром оксиді- 18%; хром - 5%, никель - 4,9%;алюминий - 12%; титан - 11,5…11,6% ден 1% дейін - артүрлі катализаторлардың салмағы бойынша.

Кеуекті СВС – блоктарда Fe-Al негізінде газдарды қатты бөлшектерден тазартутиімділігін Pd палладий материалын қолданумен салыстырғанда 18-20% тазарту сапасы артады.

Ары қарай әдіс бойынша келесі көрсеткіштер бойынша дизельдін зиянды шығындысы бағаланды: $q_{оц\ NOx}$, $q_{оц\ CO}$, $q_{оц\ CH}$, $q_{оц\ ТЧ}$. Нәтижелер 1 кестеде көрсетілген.Осында бірынғай жағдайда ЕВРО-4және ЕВРО-5 шығындар нормасын орындау жағдайлары бағаланған. Бағалау кезінде нақты шығындаргаздарды залал-сыздандырусыз және нақты шығындаргаздарды Pd палладий элементі бар кеуек өткізгін СВС- блоктарда залалсыздандырумен өткізілді.

Түйін сөздер: катализатор, өздігінен таралатын жоғары температуралық синтез (ӨЖС), қалдық газдар.

Б. Н. Азаматов[1], К. А. Ожикенев[2], Ж. К. Азаматова[1]

[1] Восточно-Казахстанский государственный технический университет им. Д. Серикбаева,
Усть-Каменогорск, Казахстан
[2]Казахский национальный исследовательский технический университет им. К. И. Сатпаева,
Алматы, Казахстан

ОЦЕНКА ЭФФЕКТИВНОСТИИСПОЛЬЗОВАНИЯ ПАЛЛАДИЯ В КАТАЛИТИЧЕСКИХ СВС-БЛОКАХ ДЛЯ ДИЗЕЛЬНЫХ ДВИГАТЕЛЕЙ

Аннотация. В настоящейработе рассматриваются вопросы очистки выхлопных газов дизельных двига-телей от оксидов азота, монооксида углерода СО, углеводородов СхНу и твердых частиц ТЧ в катализаторах из пористых проницаемых материалов, полученных СВС синтезом.

Экспериментальное исследование по определению эффективности каталитической нейтрализации отработавших газов на СВС-материалах было проведено с соблюдением следующих условий: идентичности средних диаметров, размеров пор, пористости и извилистости пор. Это достигалось тем, что базовый состав шихты содержал: легированной стали - 47,5%; оксида хрома - 18%; хрома - 5%; никеля - 4,9%; алюминия - 12%; титана - 11,5…11,6% и до 1% по массе различных катализаторов.

В результате сравнения эффективности очистки газов от твердых частиц в пористых СВС-блоках на основе Fe-Al с теми же характеристиками установлено повышение качества на 18-20 % при использовании в составе материала палладия Pd.

Далее по методике была проведена оценка вредных выбросов дизеля по показателям $q_{оцNOx}$, $q_{оцCO}$, $q_{оцCH}$, $q_{оц\ ТЧ}$, результаты которой сведены в таблицу. Здесь же выполнена оценка величин техногенной нагрузки для одинаковых условий в случаях выполнения норм выбросов ЕВРО-4 и ЕВРО-5, действительных выбросов без нейтрализации газов и действительных выбросов с нейтрализацией газов с присутствием в пористых прони-цаемых СВС-блоках палладия Pd.

Ключевые слова: катализатор, самораспространяющийся высокотемпературный синтез (СВС), выхлоп-ные газы.

Сведения об авторах:

Азаматов Багдат Нурланович – докторант кафедры «Приборостроение и автоматизация технологи-ческих процессов» Восточно-Казахстанского государственного технического университета имени Д. Серик-баева, Казахстан, специальность 6D070200 – Автоматизация и управление, e-mail: Azamatovy@mail.ru

Ожикенов Касымбек Адильбекович – кандидат технических наук, профессор, заведующий кафедрой «Робототехника и технические средства автоматики» Казахского национального исследовательского техни-ческого университета имени К.И. Сатпаева, Казахстан,. e-mail: kas_ozhiken@mail.ru, ozhikenovk@gmail.com

Азаматова Жанерке Кыдырбековна – кандидат технических наук, старший преподаватель кафедры «Приборостроение и автоматизация технологических процессов» Восточно-Казахстанского государствен-ного технического университета имени Д. Серикбаева, Казахстан, e-mail: Zhanerkeaz@mail.ru

Publication Ethics and Publication Malpractice in the journals of the National Academy of Sciences of the Republic of Kazakhstan

For information on Ethics in publishing and Ethical guidelines for journal publication see http://www.elsevier.com/publishingethics and http://www.elsevier.com/journal-authors/ethics.

Submission of an article to the National Academy of Sciences of the Republic of Kazakhstan implies that the described work has not been published previously (except in the form of an abstract or as part of a published lecture or academic thesis or as an electronic preprint, see http://www.elsevier.com/postingpolicy), that it is not under consideration for publication elsewhere, that its publication is approved by all authors and tacitly or explicitly by the responsible authorities where the work was carried out, and that, if accepted, it will not be published elsewhere in the same form, in English or in any other language, including electronically without the written consent of the copyright-holder. In particular, translations into English of papers already published in another language are not accepted.

No other forms of scientific misconduct are allowed, such as plagiarism, falsification, fraudulent data, incorrect interpretation of other works, incorrect citations, etc. The National Academy of Sciences of the Republic of Kazakhstan follows the Code of Conduct of the Committee on Publication Ethics (COPE), and follows the COPE Flowcharts for Resolving Cases of Suspected Misconduct (http://publicationethics.org/files/u2/New_Code.pdf). To verify originality, your article may be checked by the Cross Check originality detection service http://www.elsevier.com/editors/plagdetect.

The authors are obliged to participate in peer review process and be ready to provide corrections, clarifications, retractions and apologies when needed. All authors of a paper should have significantly contributed to the research.

The reviewers should provide objective judgments and should point out relevant published works which are not yet cited. Reviewed articles should be treated confidentially. The reviewers will be chosen in such a way that there is no conflict of interests with respect to the research, the authors and/or the research funders.

The editors have complete responsibility and authority to reject or accept a paper, and they will only accept a paper when reasonably certain. They will preserve anonymity of reviewers and promote publication of corrections, clarifications, retractions and apologies when needed. The acceptance of a paper automatically implies the copyright transfer to the National Academy of Sciences of the Republic of Kazakhstan.

The Editorial Board of the National Academy of Sciences of the Republic of Kazakhstan will monitor and safeguard publishing ethics.

Правила оформления статьи для публикации в журнале смотреть на сайте:

www:nauka-nanrk.kz

ISSN 2518-170X (Online), ISSN 2224-5278 (Print)

http://geolog-technical.kz/index.php/kz/

Верстка *Д. Н. Калкабековой*

Подписано в печать 11.07.2017.
Формат 70x881/8. Бумага офсетная. Печать – ризограф.
18,2 п.л. Тираж 300. Заказ 4.

Национальная академия наук РК
050010, Алматы, ул. Шевченко 28, т. 272-13-19, 272-13-18