STUDY OF THE METALS CATALYSTS AND OXIDES EFFECT ON THE EFFICIENCY OF THE CARBON GASIFICATION IN A SOLAR FURNACE.

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ИССЛЕДОВАНИЯ ВЛИЯНИЯ КАТАЛИЗАТОР МЕТАЛЛОВ, ОКИСЛОВ МЕТАЛЛОВ НА ЭФФЕКТИВНОСТЬ ГАЗООБРАЗОВАНИЯ УГЛЕРОДА В СОЛНЕЧНЫЙ ПЕЧИ.

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ANNOTATION

It has been studied in the article the matters related to use solar energy for providing the process of gasification of carbon-consisted substances with metals and metal oxides catalysts (Fe, FeO, F_2O_3) improving the productivity and efficiency of the gasification process.

АННОТАЦИЯ

В статье рассмотрены вопросы связанные с использованием солнечной энергии для проведения процесса газификации углеродсодержащих веществ в присутствии катализаторов металлов оксилов металлов (Fe, FeO, F2O3) повышающих производительность и эффективность процесса газообразования.

Keywords: solar energy, gasification, helioreactor, catalysts, solar receiver

At present, the matters related to use solar energy for providing the process of gasification of carbon-consisted substances with catalysts these are metals (Fe, Al), metal oxides, alkaline metal mixes improving the productivity and efficiency of the gasification process are discussed widely.

The advisability of the using of a catalyst or another and making method of it is determined via the economic data of the process applying it, and the best allows you to get the cheapest products of the required quality when there is the level of technology and economics.

They think based on the analyse of studied difficulties that only the cheap readily available substances can be used in fact as catalysts of coal gasification.

Aim of the work was the studying of opportunities of realizing of the cyclic processes of iron-consisted multicomponent catalysts reduction and oxidation by the steam. Water is the main source of hydrogen getting under production conditions. Many ways of conversion are been using for it with the mind that many metals have properties to displace hydrogen out of the water with the appearing of hydroxides or oxides of taken metals at the same time. The iron-vaporous method is one of the most widespread ones in the studies of hydrogen getting processes.

In the process of reusable oxidizing- reduced hydrogen production cycles it is necessary having the data about the changing of kinetic parameters and properties of materials functioning a long time in stream environment at 800-1000 ^{0}C of temperature without unloading them from the working zone of a reactor.

The investigation of the interaction between metal oxides and carbon followed by hydrogen production has been conducted in the metal solar reactor through the way of thermal oxidation.

Studying of the coal oxidation kinetics by metal oxides in the solar energy device at 700-900^0 C of atmospheric pressure was carried out in the following way: The solar rays from a paraboloidal mirror are focused to the helio reactor and the evaporator. After a certain time (30 minutes) of iron oxides reduction that

was monitored to output and contents of carbon oxides, the stream is being directed to the helio reactor but the appeared hydrogen and other gases were being gathered in the gasometer to their content chromatography. The operations were repeated triply for each temperature till getting of the reproducible results.

In all cases, the study at the solar energy device was carried out so the metal oxides reduction process had been running at the kinetic zone. In case of the line relation between a part of transformed oxygen of iron oxide (γ) and time (τ) the process is risen with the equation

$$\gamma = k\,\tau$$

Where: γ it is the level of metal oxide transformation showing with unit fraction,

γ- time in minutes

k- the reaction velocity constant coefficient proportional.

The line relationship for the metal oxide is followed under certain conditions when the process is not limited within the factors of diffusion that is if the whole grain of the iron oxide is involved in the reaction. When further reductions of oxides (FeO) inhibiting to transport the oxide grain in nuclear but CO_2 from nuclear to the surface, and the process velocity decreases due increasing of CO и CO_2 diffusion. The investigation shows that carbon oxidation of brown coals by oxygen of the iron oxides for the first period from about 50, 60 and 70 per cent of iron oxide (with temperatures 700, 800 and 900^0C respectively) the process is running on the first order and it is presented with the equation.

The catalytic action of the reduction reaction of metal oxide with coal using solar energy has been studied by us for the purpose of the process intensification.

A metal oxide reagent based on iron oxide (99,87%, Fe_20_3) 0,063 - 1 мм of fraction and brown coal are used as initial reagents.

The reagent activation is realized with the insertion of the dry potassium carbonate catalyst additive in the amount of 1% (in relation to iron oxide). Coal and reagents are mixed in a stoichiometric ratio (to complete reduction of iron oxides), the initial schicht mix has been used as a solar receiver of the solar energy device.

The experiments have been carried out by solar radiation 2514-2933 кCoul/m2·hour, and the temperature in the solar receiver changed in the 700-800°C range.

The process realized by followed reaction in two stages:

$$Fe_2O_3+2C \rightarrow 2Fe+CO+CO_2 \quad (1)$$

$$2Fe+3H_2O \rightarrow Fe_2O_3+3H_2 \quad (2)$$

For the first stage (1) it happens the coal gasification and the metal oxide reduction by 700-800°C of temperature when the evolved

oxygen generates the mix of carbon oxides CO+CO_2(table1.) through reaction to carbon. In the second stage (2) the reduced iron generates Fe_2O_3 and hydrogen (table2) through interacting with vapours of water. The oxidized reagent is transported to a generator, and the process is repeated in the same sequence.

The got mix of carbon oxides derives to the second gas-holder.

The gas has been analyzed at the chromatography ЛХМ-72,

Table 1. The reduction stage gases composition

The temperature of the reactor °C	Gas output 10^{-3} m^3/hour	The gas composition in percentage %	
		CO	CO_2
700	1.0	45.3	54.7
800	3.5	47.7	52.3
900	8.0	50.4	49.4
1000	8.5	52.0	48.0

Table 2. The oxidation stage gases composition

The temperature of the reactor °C	Gas output 10^{-3} m^3/hour	The gas composition in percentage %	
		H_2	CO_2
700	1.0	96.1	3.9
800	3.5	96.7	3.3
900	7.5	97.3	2.7
1000	07.8	98.2	1.8

As you see from the data given at tables 1 and 2 the best optimal conditions to get hydrogen is the temperature 900°. The process runs no efficiently, and the gas output decreases about twice by the 800° of temperature.

The realized way of hydrogen getting will make usage of cheap solar heat possible, fossil solid fuel to save (till per cent of 40 %) for keeping the reaction heat and getting the hydrogen of high pure without further purification.

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ЭКОНОМИЧЕСКИЙ ЭФФЕКТ ПОВЫШЕНИЯ УРОВНЯ КОМФОРТА НА РАБОЧЕМ МЕСТЕ ВОДИТЕЛЯ (МЕТОДИКА РАСЧЕТА).

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ECONOMIC BENEFIT OF IMPROVED COMFORT IN THE WORKPLACE OF THE DRIVER (METHOD OF CALCULATION).

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АННОТАЦИЯ.

В статье рассматриваются медицинский и экономический аспекты повышения уровня комфорта на рабочем месте водителя самоходной машины за счет установки водительского сиденья с повышенными виброзащитными свойствами, приведена методика расчета экономического эффекта.

ABSTRACT

The article deals with the medical and economic aspects of improving the level of comfort in the workplace of the driver of a self-propelled machine by installing a driver's seat with increased vibration-proof properties, the method of calculating the economic effect.

Ключевые слова: Рабочее место водителя, виброзащитное сиденье, экономический эффект, профессиональное заболевание.

Keywords: The driver’s workplace, vibration isolating driver’s seat, economic benefits, occupational disease.

Все машины, относящиеся к строительно-дорожной технике, при всем их многообразии, объединяет одно - повышенная вибрационная и эмоционально-физическая нагруженность водителя (оператора, машиниста), что ставит проблему создания комфортных условий на рабочем месте оператора (водителя), что имеет помимо социального аспекта (сохранение здоровья человека), также и чисто экономический аспект.

Помимо развития профессиональных заболеваний (остеохандроз, сердечно-сосудистые заболевания, язвенная болезнь и т.п.), которые ведут к потере трудоспособности высококвалифицированного работника (лечение которого стоит немало), дискомфорт на рабочем месте ведет к преждевременной усталости, к увеличению перерывов в технологическом процессе, что ведет к падению дневной выработки, а, следовательно, к уменьшению прибыли всего предприятия в целом.

Медицинские аспекты проблемы

Анализ результатов гигиенических исследований показал, что все обследованные группы рабочих (водители промышленных бульдозеров, большегрузных автомобилей, автопогрузчиков, машинисты карьерных экскаваторов, буровых станков) подвергаются комплексному воздействию трехкомпонентной общей вибрации высоких уровней, превышающей предельно-допустимые значения.

Расчет корректированного уровня виброускорения и дозы вибрации показал, что колебательная энергия, которую получают лица указанных профессий, велика и превышает норматив (предельно-допустимые уровни – ПДУ - по ускорению равны 65, 59 и 50 дБ для транспортной, транспортно-технологической и технологической вибрации соответственно).