

INVESTIGATION OF *n*-BUTANE CONVERSION ON Pd, Rh, Ru
CATALYSTS SUPPORTED BY AL₂O₃ AND SiO₂*Dana Karimova*^{1,✉}, *Saparkali Konuspaev*¹<https://doi.org/10.23939/chcht18.03.386>

Abstract. This study explored the dehydrogenation of *n*-butane using Pd, Rh, and Ru catalysts on aluminum and silicon oxide supports. Aluminum oxide (Al₂O₃) showed superior conversion of *n*-butane, especially with 1 % Pd/γAl₂O₃, yielding 31 % target alkenes. This catalyst offers potential for scaling up *n*-butane dehydrogenation technology.

Keywords: selectivity, olefins, paraffins, carrier, dehydrogenation.

1. Introduction

The products of *n*-butane conversion are a key feedstock for the production of a wide range of organic compounds^{1,2}. The dominant commercially viable product of *n*-butane dehydrogenation is 1,3-butadiene, obtained after carrying out a one-step reaction, or in combination with the oxidative dehydrogenation of 1-butylene^{3–5}. The catalytic dehydrogenation of light alkanes is the solution to meet the growing demand in the industry for olefins and the presence of a large stock of these raw materials in the Republic of Kazakhstan.

According to Li and Wang⁶, there are two commercial technologies for dehydrogenation of light alkanes: the Oleflex process and the Catofin process. However, the main disadvantages of these processes are the high cost of platinum (978 USD per troy oz (~31.1034768 grams)) and the harmful effects of chromium. At the same time, the substitutes suggested by the authors differ in their cost: Palladium (Pd) – 1,233.0 USD per troy oz, Rhodium (Rh) – 4,425.0 USD per troy oz, and Ruthenium (Ru) – 450.00 USD per troy oz⁷. Among the transition metals, Pt is the most commonly used active component of *n*-butane dehydrogenation catalysts^{8–10}. The Sn promoter was chosen to improve the selectivity of *n*-butane dehydrogenation reaction products to butenes^{11–14}.

The purpose of the research was to study the possibility of replacing Pt with metals of the VIII group of the fifth period (Pd, Rh, and Ru) supported by γ-Al₂O₃ and SiO₂. The main goal of this work was to understand the regularities of *n*-butane dehydrogenation to C₄-olefins on the prepared catalysts. In particular, it was necessary to find out which carrier is optimal for the best yield and selectivity of the target product and a lower yield of reaction by-products; which metal is the basis for the catalyst's higher activity; which temperature regime and the amount of metal salt deposited on the carrier contribute to the maximum selectivity of the target products; under what conditions the conversion of the starting compound is better.

2. Experimental

Characteristics of the catalysts. Rh, Ru, and Pd catalysts supported by Al₂O₃ and SiO₂ bases were used in the experiments. The nature of the distribution and qualitative composition of the metal on the carrier surface was determined by scanning electron microscopy using a JSM-6610LV scanning microscope (JEOL, Japan) at a resolution of 1–500 μm and a voltage of 20 kV. The highest resolution (1 μm) was used to detect the elemental composition. Under these conditions, upon irradiation of the test sample, both reflected secondary electrons and X-rays are generated. Thanks to both signals, the qualitative composition of the sample can be accurately determined. To assess the distribution of the metal over the support surface, the images were analyzed in several ranges. The specific surface area of the catalyst was calculated by the BET method, based on the mathematical description of the adsorption of a component on a homogeneous adsorbent surface. In this case, the force of interaction between the molecules of the component and the surface is considered to be stronger than the molecules of the surface among themselves, and the interaction of sorbed molecules is taken into account only in the perpendicular direction¹⁵.

Preparation of the catalysts. The carriers (aluminum oxide and silicon (IV) oxide) were loaded with 3 % and 1 % of active metals Rh, Ru, and Pd, based on

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the moisture content. Using a sieve, 1.5–1.7 mm of the support (SiO₂ and γ -Al₂O₃) were fractionated and calcined for 4 hours at 400 °C. The moisture content of the calcined carriers was determined. Metal salts (rhodium (III) chloride tetrahydrate; palladium (II) chloride anhydrous and ruthenium (IV) hydroxy trichloride) were dissolved in an equivalent amount of water in a volume of aqueous solvent for 12 hours. After the carriers were impregnated with salt solutions, the resulting catalysts were dried in air and then heated at 120 °C for 120 minutes. After drying, the catalysts were reduced in a hydrogen stream (4 h, 350 °C, Nabartherm B180).

Dehydrogenation of *n*-butane. The dehydrogenation reaction was carried out at atmospheric pressure on a fixed catalyst bed by the flow method with a space feed rate of 250 h⁻¹ at different temperatures (400–600 °C). The reactor loaded with the catalyst was uniformly heated using an electric furnace. The volume of catalyst loaded into the reactor was 5 ml; the reactor diameter was 12 mm. Butane was fed into the reactor in a downward flow, coordinating the supply with a cylinder regulator. The reaction proceeded continuously for 30 minutes. Liquid products, as a rule, were not formed or were found in trace amounts. For the analysis of gaseous reaction products of *n*-butane dehydrogenation, the mixture was first separated into individual fractions using a cooler and a high-pressure separator. This separation is based on differences in boiling points and vapor pressures of the various components. The separated gases were then

introduced into a Khromatek-Kristall 5000.2 analytical gas chromatograph equipped with a flame ionization detector (FID). This chromatography technique allows the precise separation, identification, and quantification of each component in the gas mixture. The FID, which is particularly sensitive to hydrocarbons, detects and measures the concentration of each compound at the outlet of the chromatograph, generating a chromatogram that shows the presence and amount of various hydrocarbons, including desired olefins and potential by-products, thereby providing important data on the efficiency and selectivity of the catalytic process. Regardless of the catalyst composition, the products were analyzed after the same time intervals. The separation was carried out using an Agilent GS-Gas-Pro silica gel column (60000×0.32 mm) in a helium moving phase at a flow rate of 53 mL/min and a carbon molecular sieve (Carbosieve S-II (4000×2 mm)), in a nitrogen moving phase at a flow rate of flow 50 mL/min, at 125 °C).

3. Results and Discussion

In the first stage of the work, we determined the temperature dependence of the *n*-butane conversion over 3 % Pd, Rh, Ru catalysts supported by Al₂O₃ and SiO₂. Such indicators as the percentage yield of reaction products and the selectivity of their formation were taken into account (Table 1).

Table 1. Comparative table of the main indicators of the *n*-butane conversion on carriers SiO₂/Al₂O₃ impregnated with 3 % Pd, Ru and Rh salts

Catalyst	T, °C	A, %	B, %	C, %	Selectivity, wt. %						
					H ₂	S C ₁ -C ₂	Eten	Pr	Butenes	S C ₃ -C ₅	AH
3 % Pd/ γ Al ₂ O ₃	500	6	4.2	73.3	2.8	7	1.2	5.5	66.6	13.3	3.6
	550	14	10.5	76.9	3.2	12.4	5.5	12.1	59.3	5.6	2
	600	36	23.9	67	3.9	23.4	9.9	19.5	37.6	3.8	1.9
3 % Pd/SiO ₂	500	5	3.8	80.8	0.4	2.3	1	3.2	76.6	15.7	0.8
	550	7	4.7	71.4	2.2	13.1	6.4	19.8	45.2	11.6	1.7
	600	23	15.4	67.8	1.6	26.1	15.7	37.6	14.5	3.2	1.3
3 % Rh/ γ Al ₂ O ₃	500	14	1.9	13.8	2.8	61.1	0.1	0.4	13.3	5.7	16.5
	550	19	3.2	16.7	3.7	64.1	0.1	0.6	16	4.7	10.9
	600	35	14.1	40.7	3.3	46.2	0.5	10.9	29.3	4.7	5.2
3 % Rh /SiO ₂	500	5	3.1	67	3.3	7.6	0.8	6.5	59.7	16.1	6
	550	12	7.9	68.8	2.9	18.3	3.2	19.5	46.1	6.9	3.2
	600	33	21.6	66.2	1.4	26.4	13.5	31.4	21.3	4.4	1.7
3 % Ru/ γ Al ₂ O ₃	500	6	4.2	73.3	2.8	7	1.2	5.5	66.6	13.3	3.6
	550	14	10.5	76.9	3.2	12.4	5.5	12.1	59.3	5.6	2
	600	36	23.9	67	3.9	23.4	9.9	19.5	37.6	3.8	1.9
3 % Ru/SiO ₂	500	5	3.8	80.8	0.4	2.3	1	3.2	76.6	15.7	0.8
	550	7	4.7	71.4	2.2	13.1	6.4	19.8	45.2	11.6	1.7
	600	23	15.4	67.8	1.6	26.1	15.7	37.6	14.5	3.2	1.3

Note: T – temperature; A – percentage of conversion; B – yield of unsaturated hydrocarbons C₂-C₄; C – selectivity of conversion of C₂-C₄ unsaturated hydrocarbons; S – Saturated hydrocarbon; Pr – Propene; AH – Aromatic hydrocarbons.

Source: compiled by the authors.

According to the analytical results, the conversion of *n*-butane increases with increasing temperature up to 600 °C, which was the maximum in this study. 3 % Ru/ γ -Al₂O₃ shows the highest conversion rate of 39 % with a 20.5 % yield of C₂-C₄ olefins, while at 3 % Ru/SiO₂ the conversion reaches 27 % at a yield of 18.8 %, which is lower than on alumina. Nevertheless, 3 % Ru/SiO₂ shows the best selectivity of 70 % at 600 °C. Similar indicators are observed for palladium-containing catalysts. However, 3 % Pd/ γ -Al₂O₃ at 600 °C has a good selectivity (67 %) compared with 3 % Ru/ γ -Al₂O₃. The rhodium catalyst has high conversion rates on both supports, but on 3 % Rh/ γ -Al₂O₃ the yield of olefinic hydrocarbons and the selectivity are low, 14.1 % and 40.7 %, respectively. The lowest catalytic activity among the 3 % catalysts is exhibited by Pd/SiO₂ at a conversion of 23 % and a yield of olefins 15.4 %.

During the reaction, such unsaturated hydrocarbons as isomers of butene (1 and 2), propene and ethene were

obtained. It should be noted that 2-butene exists in *cis* and *trans* forms. Regardless of the reaction temperature, pentane and isopentane are found in trace amounts, and when the temperature reaches 500 °C, such arenes as toluene and benzene are formed¹⁷. The higher the temperature, the greater the yield of unsaturated hydrocarbons, ethane and methane, however, the content of C₃-C₅ paraffins is reduced (as a result of the gradual depletion of *n*-butane)¹⁸. At the same time, the temperature has practically no effect on the yield of arenes. Table 2 presents data on the chemical composition of butane conversion products on SiO₂/Al₂O₃ carriers impregnated with 3 % Pd, Ru, and Rh salts.

It should be noted that on alumina the main reaction is the dehydrogenation of butane to obtain butene isomers, and cracking is a side reaction, while on silicon oxide it is the opposite. The results of the *n*-butane conversion on samples with a metal concentration of 1 % are presented in Tables 3 and 4.

Table 2. Composition of *n*-butane conversion products on SiO₂/Al₂O₃ supports impregnated with 3 % Pd, Ru, and Rh salts

Catalyst	T, °C	A, %	Yield of conversion products, wt. %							
			H ₂	Methane	Ethane	Eten	Propene	Butenes	Alkanes C ₃ -C ₅	Arenas
3 % Pd/ γ Al ₂ O ₃	500	6	0.2	0.3	0.1	0.07	0.3	3.8	95.1	0.2
	550	14	0.4	1.1	0.6	0.7	1.6	8.1	87.2	0.3
	600	36	1.4	5.2	3.1	3.5	7	13.4	65.7	0.7
3 % Pd/SiO ₂	500	5	-	0.1	-	-	0.2	3.6	96	-
	550	7	0.1	0.6	0.3	0.4	1.3	3	94.2	0.1
	600	23	0.4	3.8	2.1	3.6	8.6	3.3	78	0.3
3 % Rh/ γ Al ₂ O ₃	500	14	0.4	8.3	0.1	-	0.1	1.8	87	2.3
	550	19	0.7	12.1	0.3	-	0.1	3.1	81.5	2.1
	600	35	1.2	13.6	2.4	0.2	3.8	10.1	67	1.8
3 % Rh/SiO ₂	500	5	0.2	0.3	0.1	0.04	0.3	2.8	96.1	0.3
	550	12	0.3	1.4	0.7	0.4	2.2	5.3	89.3	0.4
	600	33	0.5	5.3	3.3	4.4	10.2	6.9	68.8	0.5
3 % Ru/ γ Al ₂ O ₃	500	8	0.3	2	0.2	0.02	0.2	3.6	93.2	0.6
	550	21	0.8	7.5	1.5	0.07	1.2	7	80.6	1.4
	600	39	1.6	9.1	4.1	1.6	6	12.9	63	1.7
3 % Ru /SiO ₂	500	5	0.04	0.07	0.04	0.07	0.16	3.6	95.9	0.1
	550	9	0.09	0.77	0.42	0.76	1.84	4.2	91.8	0.1
	600	27	0.22	4.35	2.36	4.79	9.16	4.9	74	0.3

Note: T – temperature; A – conversion percentage.
Source: compiled by the authors.

As with the 3 % samples, the *n*-butane conversion increases with increasing temperature. The general pattern for 1 % and 3 % catalysts is that on alumina-based catalysts, the hydrocarbon conversion and yield of olefinic hydrocarbons are higher than on catalysts supported by silicon oxide. The yields of olefins are 1 % higher than on 3 % catalysts; the exception is 1 % Ru/SiO₂ with a yield of 11.7 %, while on a 3 % sample, the yield of these compounds is 18.8 %. The selectivity for the formation of

olefinic hydrocarbons on 1 % catalysts is higher than on 3 % ones, in particular, on 1 % Rh/ γ Al₂O₃, where it varies from 42.9 % to 58.8 %, while on 3 % the selectivity varies from 13.8 % up to 40.7 %. Thus, the activity of 1 % catalysts on alumina support is significantly higher than on silicon oxide support. Table 4 shows the composition of *n*-butane conversion products on γ -Al₂O₃, SiO₂ catalysts containing 1 % palladium, rhodium, and ruthenium. It should be noted that, just as on 3 % samples,

the dehydrogenation of butane to butenes prevails on catalysts on alumina, while cracking of *n*-butane on silica. Thus, catalysts with metal concentrations of 1 % are the most active. An increase in the concentration of the

introduced metal to 3 % leads to a decrease in catalytic activity and selectivity. Fig. 1 presents the comparative activity of 1 % catalysts based on the conversion of butane to alkenes with a carbon chain length C₂-C₄.

Table 3. Comparative table of the main indicators of the *n*-butane conversion on carriers SiO₂/Al₂O₃ impregnated with 1 % Pd, Ru and Rh salts

Catalyst	T, °C	A, %	B, %	C, %	Selectivity, wt. %						
					H ₂	S C ₁ -C ₂	Eten	Pr	Butenes	S C ₃ -C ₅	AH
1 % Pd/γAl ₂ O ₃	500	5	3.7	71.8	3	8.2	2.2	10	59.6	14.6	2.4
	550	16	12.3	78.4	3.2	12.1	5.5	13	59.9	5	1.3
	600	45	31	68.9	3.4	21.4	9.5	17	42.4	4.3	1.9
1 % Pd/SiO ₂	500	5	3.7	79.8	0.5	3.1	1.5	4.8	73.5	15.6	1.1
	550	7	5.5	75	0.5	13.4	8.1	21.8	45.1	10	1.1
	600	23	16.2	70.2	0.5	25	18	37.3	14.9	3.2	1.1
1 % Rh/γAl ₂ O ₃	500	10	4.4	42.9	4.9	29.2	0.5	4	38.4	8.2	14.8
	550	21	10.3	48.6	4	31.3	0.6	7.3	40.7	5.3	10.9
	600	45	26.4	58.8	3.4	29.2	6.3	17.1	35.4	4.8	3.8
1 % Rh/SiO ₂	500	5	3.8	77.2	1.4	4	1.7	5.6	69.9	14.8	2.7
	550	9	7	74.5	1.2	14.9	7.9	22.2	44.4	7.7	1.7
	600	28	19.1	68.7	0.9	25.6	16	34.5	18.2	3.6	1.2
1 % Ru/γAl ₂ O ₃	500	5	3.6	72.7	2.7	6.6	1.7	7.8	63.2	15.4	2.7
	550	18	13.5	77.1	3.6	12.6	3.1	9.5	64.5	5.4	1.3
	600	44	30.1	68.2	3.6	20.7	6.9	13.8	47.5	5.2	2.3
1 % Ru/SiO ₂	500	5	3.7	80.2	0.3	1.5	0.9	1.9	77.4	16.9	1.2
	550	6	4.8	77.4	0.4	9.2	5.7	14.3	57.3	12.1	1
	600	16	11.7	71.7	0.4	22.7	16.4	34	21.3	4.4	0.8

Note: T – temperature; A – percentage of conversion; B – yield of unsaturated hydrocarbons C₂-C₄; C – selectivity of conversion to unsaturated hydrocarbons C₂-C₄; S – Saturated hydrocarbon; Pr – Propene; AH – Aromatic hydrocarbons.

Source: compiled by the authors.

Table 4. Composition of *n*-butane conversion products on SiO₂/Al₂O₃ carriers impregnated with 1 % Pd, Ru, and Rh salts

Catalyst	T, °C	A, %	Yield of conversion products, wt. %							
			H ₂	CH ₄	Ethane	Eten	Propene	BI	S C ₃ -C ₅	AH
1 % Pd/γAl ₂ O ₃	500	5	0.15	0.3	0.12	0.11	0.5	3	95.6	0.1
	550	16	0.5	1.2	0.69	0.87	2	9.4	85.1	0.2
	600	45	1.52	5.6	3.97	4.28	7.7	19	57	0.9
1 % Pd/SiO ₂	500	5	0.02	0.09	0.05	0.07	0.22	3.4	96.1	0.05
	550	7	0.04	0.62	0.36	0.59	1.59	3.3	93.4	0.08
	600	23	0.12	3.73	2.05	4.16	8.61	3.4	77.6	0.26
1 % Rh/γAl ₂ O ₃	500	10	0.5	2.8	0.2	0.05	0.4	4	90.5	1.5
	550	21	0.9	5.6	1.1	0.12	1.6	8.7	79.8	2.3
	600	45	1.5	8.7	4.4	2.85	7.7	15.9	57.3	1.7
1 % Rh/SiO ₂	500	5	0.07	0.12	0.07	0.08	0.27	3.4	95.8	0.1
	550	9	0.12	0.86	0.53	0.73	2.07	4.1	91.4	0.2
	600	28	0.24	4.48	2.64	4.46	9.61	5.1	73.1	0.3
1 % Ru/γAl ₂ O ₃	500	5	0.1	0.2	0.1	0.1	0.4	3.2	95.8	0.1
	550	18	0.6	1.5	0.7	0.5	1.7	11.3	83.5	0.2
	600	44	1.6	5.3	3.8	3.1	6.1	20.9	58.2	1
1 % Ru/SiO ₂	500	5	0	0	0	0	0.1	3.5	96.2	0.1
	550	6	0	0.4	0.2	0.4	0.9	3.5	94.6	0.1
	600	16	0.1	2.4	1.3	2.7	5.6	3.5	84.4	0.1

Note: T – temperature; A – conversion percentage; BI – Butene isomers; S – Saturated hydrocarbons; AH – Aromatic hydrocarbons.

Source: compiled by the authors.

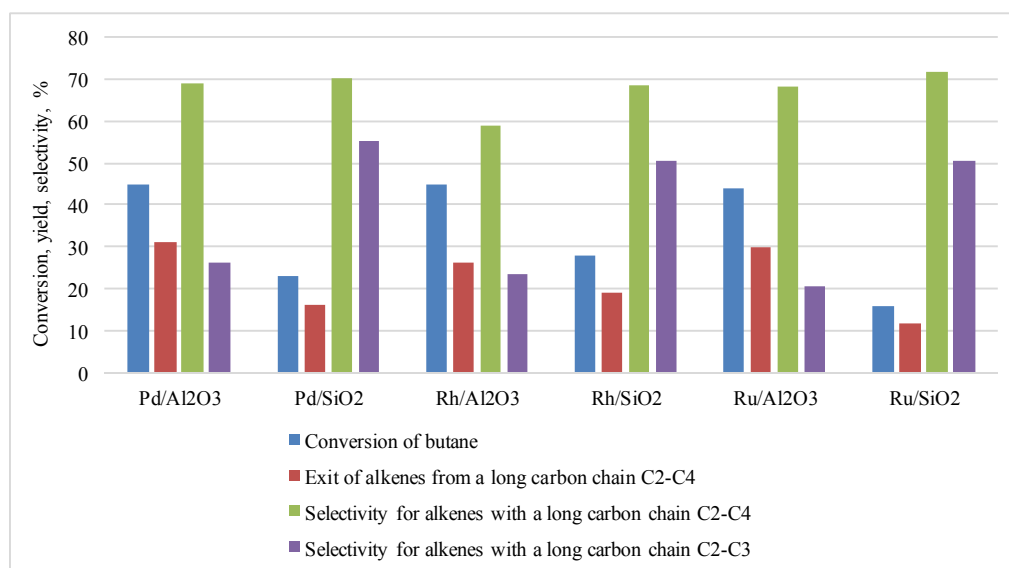


Fig. 1. Influence of the nature of the modifying metal and support on the conversion of *n*-butane, the yield and selectivity of the formation of olefins C₂-C₄ and C₂-C₃ ($T = 600$ °C, $W = 250$ h⁻¹)

Source: compiled by the authors.

Table 5. Metal content and specific surface of samples

Catalyst	Actual metal content, %	S_{sp} , m ² /g
1 % Pd/ γ -Al ₂ O ₃	1.23	232
3 % Pd/ γ -Al ₂ O ₃	3.18	221
1 % Pd/SiO ₂	0.86	355
3 % Pd/SiO ₂	2.58	322
1 % Rh/ γ -Al ₂ O ₃	0.95	229
3 % Rh/ γ -Al ₂ O ₃	2.95	216
1 % Rh/SiO ₂	1.15	373
3 % Rh/SiO ₂	3.29	375
1 % Ru/ γ -Al ₂ O ₃	0.99	223
3 % Ru/ γ -Al ₂ O ₃	2.82	218
1 % Ru/SiO ₂	1.23	363
3 % Ru/SiO ₂	3.16	374

Source: compiled by the authors.

The highest activity was found on a 1 % palladium catalyst with an aluminum oxide support: at the maximum studied temperature the selectivity for the formation of alkenes is 68.9 %, and the yield is 31 % upon conversion of 45 % of the starting compound. The conversion of *n*-butane and the selectivity of C₂-C₄ olefinic hydrocarbons formation on a 1 % Pd/SiO₂ sample were determined as 23 and 70.2 %, respectively. For the carrier of silicon oxide in the process of converting *n*-butane, there is a decrease in the conversion and yield of olefin hydrocarbons C₂-C₄ and an increase in olefin hydrocarbons C₂-C₃ in all

samples.^{19,20} Table 5 shows the actual metal content and specific surface area.

The actual metal content for 1 % samples ranges from 0.86 to 1.23 %, for 3 % samples – from 2.58 to 3.29 %. Specific surface areas for catalysts supported by γ -Al₂O₃ are in the range of 216–232 m²/g, and for catalysts supported by SiO₂ – 322–375 m²/g. So, based on the data obtained, the following regularity is noticeable: on catalysts based on alumina, butenes predominate in the reaction products from olefin hydrocarbons, while on catalysts where the carrier is silicon oxide, olefin

hydrocarbons C₂-C₃ predominate^{21, 22}. Therefore, it is advisable to use aluminum oxide as a carrier for 1 % catalysts to increase the selectivity of the target reaction products.

In this case, butane conversion is the highest on 1 % Rh and Pd alumina-supported catalysts and reaches 45 % at 600 °C. The selectivity for unsaturated hydrocarbons is preferable for Palladium. At the same time, the selectivity is 21 % for saturated hydrocarbons, and 2 % for aromatic hydrocarbons. The lowest selectivity for arenes and alkanes was found for 1 % Ru on a silicon oxide base (0.8 % and 1.5 % at 600 °C and 500 °C, respectively). Thus, fewer by-products are generated when using ruthenium as a silicate carrier, whereas the selectivity for unsaturated hydrocarbons is more than 70 %. However, the conversion index for the initial compound is almost three times lower than for Palladium on Al₂O₃ at 600 °C and 9 times lower at 500 °C. Thus, it turns out that 1 % Pd/Al₂O₃ (with a specific surface area of 232 m²/g) is the best catalyst for the production of olefins compared to other catalysts studied.

4. Conclusions

The study included the investigation of metal catalysts of group VIII of the fifth period, namely 1 % and 3 % Pd, Rh and Ru catalysts supported by γ -Al₂O₃ and SiO₂ for the dehydrogenation of *n*-butane. The results showed that the use of a smaller amount of metal on the catalyst (1 % compared to 3 %) leads to higher *n*-butane conversion rates and increased yields of target products. In addition, the use of Al₂O₃ as a support material resulted in higher conversion percentages. The selectivity for generating hydrocarbons of the alkene series was higher for 1 % catalysts compared to 3 % catalysts. Among the 3 % catalysts, ruthenium on γ -Al₂O₃ showed the highest conversion percentage (39 %), while ruthenium on SiO₂ showed the highest selectivity (70 %).

When Al₂O₃ was used as a catalyst support, the dominant dehydrogenation products were butenes. In contrast, SiO₂-supported catalysts primarily resulted in butane cracking reactions with the formation of by-products, including alkanes, arenes, ethane, ethene, propene, and methane. The most active catalyst was identified as 1 % Pd/ γ -Al₂O₃, showing high olefin selectivity, yield, and *n*-butane conversion, along with a specific surface area of 232 m²/g. It was noteworthy that the selectivity for C₂-C₄ unsaturated hydrocarbons on a silicon oxide support with 1 % Pd was 70 %, similar to that for 1 % Pd/ γ -Al₂O₃. However, 1 % Pd/SiO₂ achieved a lower degree of *n*-butane conversion (23 %).

Thus, the study showed that the use of a 1 % Pd/Al₂O₃ catalyst is a promising alternative to traditional

oil cracking methods for the production of butene isomers and other unsaturated hydrocarbons. Future research prospects include investigations on the conversion rates, selectivity, and yields of target products in *n*-butane dehydrogenation reactions using heterogeneous metal catalysts, with potential applications in the field of hydrocarbon production and refining.

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ДОСЛІДЖЕННЯ КОНВЕРСІЇ *n*-БУТАНУ НА Pd, Rh, Ru КАТАЛІЗАТОРАХ НА НОСІЯХ Al₂O₃ ТА SiO₂

Анотація. У роботі досліджено дегідрування *n*-бутану з використанням Pd, Rh та Ru каталізаторів на носіях з оксидів алюмінію та кремнію. Оксид алюмінію (Al₂O₃) показав кращу конверсію *n*-бутану, особливо з 1 % Pd/γ-Al₂O₃, з виходом цільових алкенів 31 %. Цей каталізатор має потенціал для масштабування технології дегідрування *n*-бутану.

Ключові слова: селективність, олефіни, парафіни, носій, дегідрування.