SELECTION THE OPTIMAL TECHNOLOGICAL PARAMETERS FOR THE PROCESSING OF STABLE GAS CONDENSATE INTO GASOLINE COMPONENTS ON ZEOLITE

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The production of commercial automobile gasoline in accordance with the requirements of regulatory documents is the main task of any leading producer of petroleum products.

Automobile gasoline is regulated by a number of indicators: octane number by research and motor methods (RON and MON); saturated vapor pressure; density; content of olefins, aromatic hydrocarbons, benzene, etc.

The most significant indicators are RON, MON, and benzene content [1]. Today, it is important to obtain high-octane components of gasoline from non-traditional feedstock by processing on the zeolite catalysts [2].

The experiment was carried out on a laboratory catalytic unit using a zeolite catalyst of the KN-30 brand.

Using the Compounding software package, the characteristics of the feedstock stable gas condensate (table 2) and the products (Pr) obtained during the tests (table 3) were calculated, based on the results of chromatographic analysis.

Table 3 shows a strict dependence of the increase in RON and MON, as well as the content of benzene in zeoforming products with an increase in the process temperature. Analyzing the effect of the process pressure – the highest value of the RON, MON, as well as the lowest content of benzene is observed at a pressure of 0.35 MPa (average pressure).

Similar trends are observed for the feedstock space velocity – the maximum value of RON, MON, and the minimum content of benzene is achieved at the average feedstock space velocity (3 h^{-1}). Thus, in contrast to the temperature (direct dependence), the dependence of the main indicators of the quality of zeoformats on the pressure and feedstock space velocity has an extreme. It is optimal to perform zeoforming of stable gas condensate at average temperature, pressure and feedstock space velocity.

From the point of view of involvement in the production of automobile gasoline, the most preferred products are products №4 and №6 (the lowest content of benzene at high RON and MON).

Based on the obtained results, it can be concluded that the zeoforming of stable gas conden-

Table 1. Conditions for laboratory testing

Conditions	Pr 1	Pr 2	Pr 3	Pr 4	Pr 5	Pr 6	Pr 7	Pr 8	Pr 9
T, °C	325	350	375					400	425
P, MPa	0.25					0.35	0.45	0.25	
V, h^{-1}	2			3	4	2			

Table 2. Characteristics of stable gas condensate

Characteristic	Value
RON	67.2
MON	64.0
Benzene content, % vol.	0.17

Laboratory tests were performed with variations in process technological parameters such as temperature (T), pressure (P) and volume feed rate (V). The full process conditions are shown in table 1.

Table 3. Characteristics of zeoforming products

Characteristic	Pr 1	Pr 2	Pr 3	Pr 4	Pr 5	Pr 6	Pr 7	Pr 8	Pr 9
RON	73.7	81.7	85.1	84.2	83.1	87.4	76.5	87.6	93.0
MON	70.4	77.2	79.9	79.7	78.8	82.6	71.8	81.9	86.5
Benzene content, % vol.	0.25	0.63	1.42	0.06	0.07	0.06	0.60	2.67	3.92

sate for the purpose of production commercial gasoline components is most appropriate for the following technological parameters: 1) T = 375 °C, P = 0.25 MPa, V = 3 h^{-1} (Product №4); 2) T = 375 °C, P = 0.35 MPa, V = 2 h^{-1} (Product №6).

References

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SYNTHESIS OF COMPLEX OXIDES FOR NUCLEAR FUEL IN LOW-TEMPERATURE PLASMA

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Ceramic nuclear fuel made of uranium dioxide has a number of significant drawbacks: low thermal conductivity, high brittleness, tendency to crack, a rather short cycle of use, and a limited resource of the uranium-235 isotope [1]. This has caused a slowdown in recent years in the development of nuclear energy in a number of countries.

A promising trend today is the creation of dispersion nuclear fuel, which is characterized by the absence of contacts between particles of fissile material due to their uniform distribution in the matrix and has the following advantages: high thermal conductivity and good mechanical properties, more complete fissile material burn, high radiation resistance and strength, localization of fission products in matrix [2].

Common disadvantages of the technologies used to obtain complex oxide compositions from solutions (usually nitric-acid) are: multi-staging, high cost of processing raw materials, inhomogeneous phase distribution, the need to use much chemicals.

At the same time, the technology of synthesis of oxides in air plasma has the following advantages: one-staging, homogeneous distribution of phases with a given stoichiometric composition, the ability to actively influence the size and morphology of particles [3, 4].

It should be noted that the processing of nitric-acid solutions in plasma is quite expensive. To reduce energy consumption, it needs to add any organic component into the solutions, which, when oxidizing in the air plasma, creates additional energy, allowing to increase the consumption of the processed solution and, thus, increase the yield of the target product.

The work represents carried out thermodynamic modeling of plasmachemical synthesis of complex oxide compositions from water-organic nitrate solutions (WONS), consisting of fissile material (inclusion) and matrix. Uranium dioxide was considered as a fissile inclusion, and magnesium oxide as the matrix material, acetone were used as organic component. The proportion of fuel inclusion in the target complex oxide composition was selected within the range of 95 %– 85 %, the proportion of the matrix within 5 %– 15 %.

Based on the modeling results, the optimal WONS based on uranyl nitrate, magnesium nitrate and acetone were calculated, and the optimal modes (WONS–air ratios) of the WONS plasma treatment were calculated. It was shown that with an excess of air, non-target products (UO_3, U_3O_8, U_4O_9) are formed from the initial solutions, with a deficiency of air – products of incomplete thermal decomposition of hydrocarbons in WONS (soot). It was shown that the optimal air fraction varied in the range of 69 %– 71 %.

The results of the studies can be used to calculate the plasmachemical synthesis of complex oxide compositions for dispersion nuclear fuel.

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