It is evident from these dependences that the most acceptable for the further experiments are samples 3, 5, 6 and 8, because they don't have so many stresses, because that could cause very high value of safety factor. From all this factors we choose the most rational sample 5, because it has the highest level of displacements and secures the minimum clearance in the thread connection at any stress.

During the projecting of new boring heads and cylindrical pilots the foreign products of the world's leaders of instrumental industry, the analyses of the patents were done. The prior investigations of construction were done, the best results had the split bushing that had width and step of the slot twice longer then thread pitch and depth of the slot was 4/5 of bushing diameter. In further experiments we plan to ascertain which of the methods prior resize (pressing or release) is better for in thread connection and when the clearance in the thread connection will be at its minimum level.

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KINETIC REGULARITIES OF THE DIESEL FUEL HYDRODESULFURIZATION AT THE L-24/6 UNIT

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In accordance to Technical Regulations of the Customs Union TR TS 013/2011, the marketing of the diesel fuel class lower than K5 will be prohibited in the Republic of Belarus from the 1st of January 2015. The K5-class diesel fuel is produced on L-24/6 unit of JSC Naftan since 2012. The results of the study of the unit operation are presented in this article.

Hydrotreating is the process of the heteroatoms (S, N, O) removing from the feed by the hydrogenation of sulfur compounds, nitro compounds and oxygen compounds. Simultaneously the hydrogenation of unsaturated and polycyclic hydrocarbons occurs; the metal atoms also are removed [1]. The requirements of the technical, normative and legal documents limit the sulfur and polycyclic aromatic hydrocarbon content. It is not difficult for JSC Naftan to achieve the requirements for the latter due to the nature of the feed. To reduce the sulfur content to 10 ppm (environmental class K5), a deep modernization of equipment is required. With this aim the new reactor block has been built at the L-24/6 unit, which is the part of the Complex of Hydrotreating, Mild Hydrocracking and Rectification.

Since the main goal of the hydrotreating process is to remove sulfur compounds, the kinetics of the desulfurization reactions is studied in this research. The process takes place in an axial multibed reactor. The molecules of liquid and partially vaporized feed react with hydrogen molecules on the catalyst surface. In this reactor the Albemarle's catalyst system is loaded. This system is a combination of inert compounds, auxiliary low-active catalysts and main Cobalt Molybdenum hydrotreating catalyst KF-757. The scheme of the reactor is shown in Fig. 1.

The kinetics of the hydrotreating process is influenced by many factors, such as the reaction temperature, the time that reactants contact with catalyst, hydrogen partial pressure, total system pressure, boiling range of the feed, hydrosulfide partial pressure, uniform distribution of liquid flow through the reactor section, catalyst life-cycle, etc. [2] Some parameters are uncontrollable; some are nondescript in commercial unit conditions. The control of hydrotreating process primarily carried out by temperature change in the reaction zone. The temperature is a part of the Arrhenius equation – one of the main chemical kinetics equations [3]:

$$k = A \cdot e^{-\frac{E_a}{RT}},$$

where k – rate constant;

A – pre-exponential factor, which characterizes the frequency of interacting molecules collisions;

E_a – activation energy;

R – universal gas constant;

T – temperature.

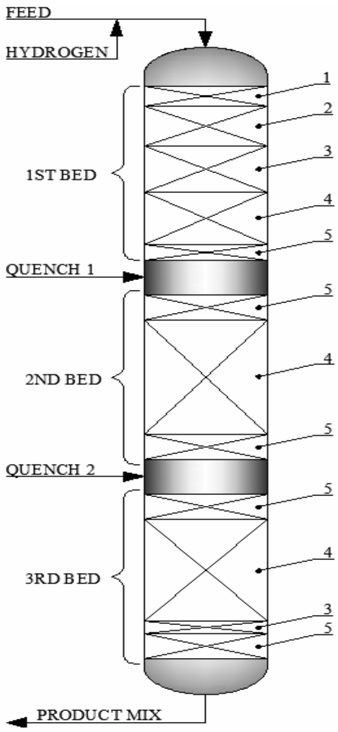

Fig. 1. The scheme of the reactor P-201:
1 – inert filling KG-55; 2 – olefin hydrogenation catalyst KG-542; 3 – denitrification and hydrogenation catalyst KF-841; 4 – desulfurization catalyst KF-757; 5 – inert filling (ceramic balls)

As the temperature changes along the reactor height, so the weighted average bed temperature (*WABT*) is considered commonly:

$$WABT_i = \frac{1}{3} T_{i,in} + \frac{2}{3} T_{i,out},$$

$$WABT = \frac{\sum (WABT_i \cdot V_i)}{\sum V_i},$$

where $WABT_i$ – weighted average bed temperature of the i-th catalyst layer;

$T_{i,in}$, $T_{i,out}$ – inlet and outlet temperature of the i-th catalyst layer accordingly;

V_i – volume of the i-th catalyst layer.

The using of the Arrhenius equation for the calculations allows to establish the relationships between such important and available for analysis parameters, such as reaction time (or inverse value – liquid hourly space velocity, LHSV), the sulfur content in feed and product, weighted average bed temperature [4, 5]. In this case the influence of other parameters is not considered. Typically, the value of these parameters (hydrogen content; the system pressure; flow rate of recycle gas, make-up gas and purge gas) does not vary significantly throughout the unit operation time.

As a result of study there was obtained dependences shown in Figures 2 – 5. The average annual technological and quality values were taken to make calculations:

volume feed rate	108,4 m^3/h;
sulfur content in feed	0,886 %wt.;
sulfur content in product	9,083 mg/kg.

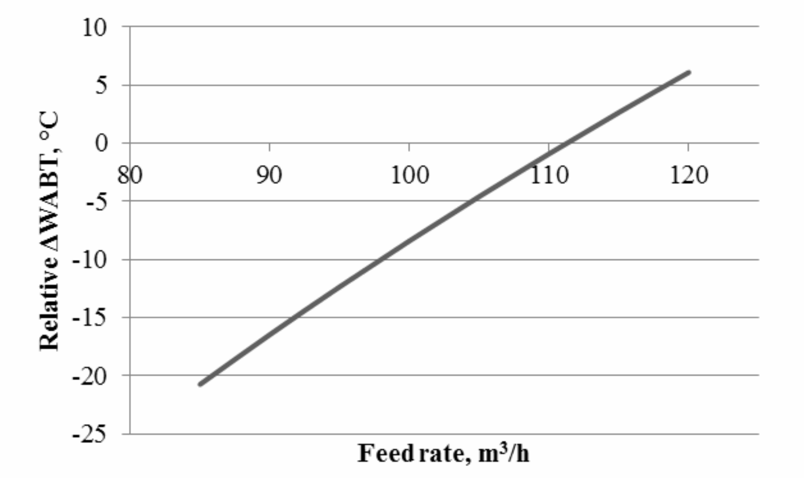

Fig. 2. Variation of weighted average bed temperature versus volume feed rate

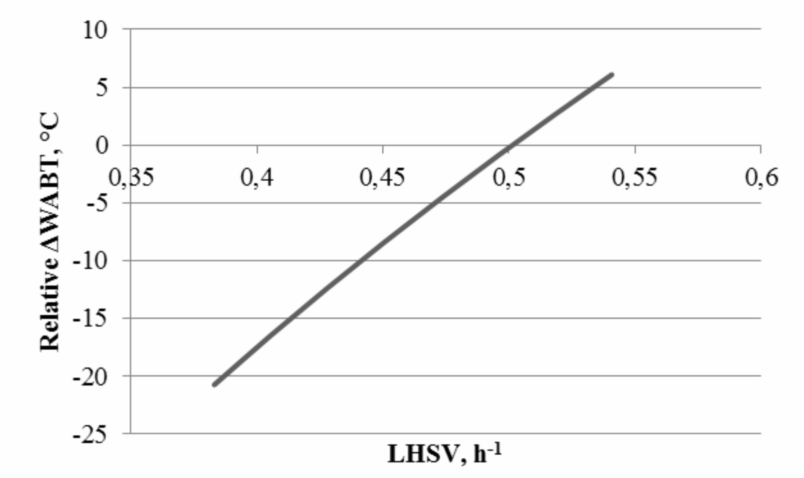

Fig. 3. Variation of weighted average bed temperature versus liquid hourly space velocity

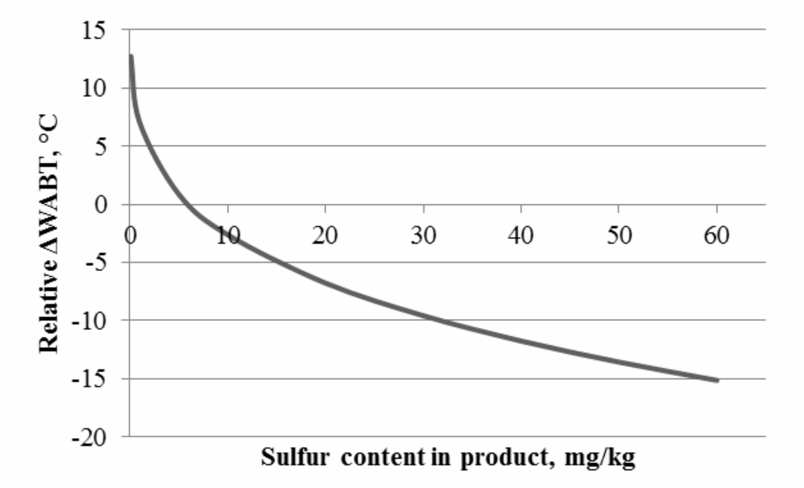

Fig. 4. Variation of weighted average bed temperature versus sulfur content in product

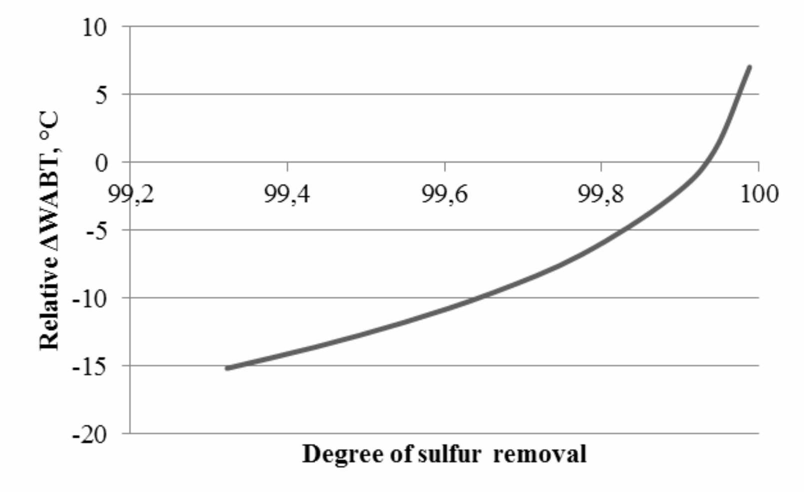

Fig. 5. Variation of weighted average bed temperature versus degree of desulfurization.

Due to the obtained graphs listed above, there is the possibility to predict required increasing or decreasing of the temperature in reaction zone. These changes can be caused, for example, by variations in productivity of the unit or by changes in desired degree of sulfur removing.

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TECHNOLOGICAL CHARACTERISTICS OF THE SURFACE OF THE CUTTING TOOLS AFTER THERMOCHEMICAL TREATMENT

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In modern machine industry more and more attention is paid to reliability and durability of the cutting tools. As a consequence, a large number of experiments and research for the purpose to increase life duration of cutting tools and their operating reliability is carried out. One of the methods to improve these characteristics is a thermochemical treatment.

Thermochemical treatment (TCT) is a universal method of surface alloying which provides formation of diffusion coatings on steel, cast iron, hard alloys.

Roughness of surface is one of the most important characteristics defining the operating characteristics of the cutting tool. Its value influences on the resistance of the cutting tool and on temperature and wear rate both of the front surface and the back surface.

Influence of the application of the diffusion layers on the surface roughness of the cutting tool is shown in Table 1. The surface roughness of the samples before and after saturation is evaluated on profilograph (model 201 according to State Standard 2789-73). Class of roughness was determined by the magnitude of the arithmetic average of profile R_a, which determined at five sites of test surface. Roughness of surface after