Also, impurities of S, Ti, W, Pb, Bi, Pd are found, the total mass of which does not exceed ~3.5% on average, which indicates a fairly high purity of the resulting product.

Thus, the paper shows the results of the analysis of powder materials of the molybdenum, carbon, nitrogen system by scanning electron microscopy.

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HYDROCRACKING FEEDSTOCK COMPOSITION AND PROPERTIES INVESTIGATION FOR HYDROCARBON GROUP ANALYSIS

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The basic principle of hydrocracking is the transformation of large high boiling hydrocarbon molecules in the presence of hydrogen into smaller molecules with a lower boiling point. This transformation occurs due to the breaking of carbon-carbon bonds or the removal of heteroatoms connecting the two unbonded parts of the hydrocarbon. The feedstock of hydrocracking is usually vacuum gas oil, and primary products of the process are more valuable and light motor fuels and their components.

The quality of the products varies greatly depending on the process conditions and the feedstock composition. The product yield decreases over time due to catalyst deactivation. For these reasons, constant feedstock and products quality monitoring as well as catalyst activity monitoring are very important. Laboratory analysis of feedstock, products and catalyst samples is time-consuming and cannot provide real-time control. In this case, it is most expedient to apply a predictive model of the hydrocracking process, developed by the mathematical modeling based on the feedstock and products composition data. The predictive model is based on actual operational data of the hydrocracking unit and, therefore, describes the actual process conditions, which allows high level quality control of the products. The aim of this work is to obtain data on the refractive indices (RI) of feedstock and products of hydrocracking process to enhance the predictive model.

RI of hydrocarbons makes it possible to estimate their structure, as well as their mixtures composition, since for a chemical compound at a certain temperature it is constant, and for mixtures it is additive [1]. The RI of hydrocarbons or petroleum products depends on the compounds chemical structure and increasing in the following order: alkanes < alkenes < alkylcyclopentanes < alkylcyclohexanes < alkylbenzenes < alkylnaphthalenes [1]. The relationship between density and RI is linear. RI of the hydrocarbon increases with density increasing. Different hydrocarbon groups have different dependency factor of RI on molecular weight. The molecular weight has the greatest influence on the RI of paraffinic hydrocarbons, and increases with chain lengthening. Alkyl aromatic hydrocarbons are an exception. The RI of this hydrocarbons group decreases with lengthening of the side chains and an increase in their amount [1]. It is possible to calculate the structure-group composition of oil fractions, knowing the RI in combination with density value and molecular weight. Therefore, the values of these features play a key role in development of mathematical model of vacuum gas oil hydrocracking process.

Figure 1 shows dependence graphs of the refractive index on the aromatics and paraffins content in the feedstock and hydrocracking products. With an increase in the aromatics content, the refractive index value increases; for paraffins, an inverse relationship is observed. These graphs confirm the above statement about the different effect of different hydrocarbons groups on the refractive index. Numbers in Figure 1 and in Table 1 are sample numbers: 1 – R-2004; 2 – R-2002; 3 – Summer diesel fuel; 4 – R-2003; 5 – 2nd stage feed; 6 – the 2nd line feed; 7 – 1st line feed.

The table also presents the RI evaluation results for 7 samples of hydrocracking feedstock and products. The data obtained is used to determine the structural group composition of feedstock and products compounds and to enhance mathematical models of the process.

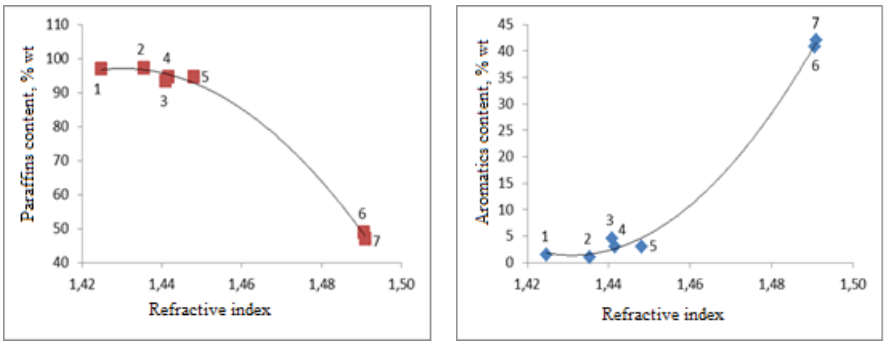

Fig. 1. *Dependence graphs of the refractive index on the hydrocracking feedstock and products paraffins and aromatics content*

Table 1. RI evaluation results for hydrocracking feedstock and products

Temperature	№1	№2	№3	№4	№5	№6	№7
50 °C	1.4246	1.4354	1.4408	1.4416	1.448	1.4906	1.491
20 °C	1.4366	1.4474	1.4528	1.4536	1.46	1.5026	1.503

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INVESTIGATION OF ACID-BASE PROPERTIES OF NATURAL MATERIALS

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In connection with the desire to reduce the cost of sorption processes, it seems very promising to use natural mineral. Natural sorbents are in high demand today, because they have a low cost and significant sorption capacity [1], [2], therefore, their use in the process of purification makes it possible to exclude the stage of adsorbent regeneration [2]. A review of publications and scientific papers showed that the study and use of materials with high sorption properties is an urgent task. To date, the sorption mechanism has not been studied in detail enough and requires further study and research [1]. With the progressive development of the chemical industry, the requirements for the properties and quality of sorbents are increasing. As a result, the search for new effective sorbents with high adsorption properties that directly depend on the content of elements and specific surface area is urgent [3].