after laser processing because of the laser ablation process. Limitations included toxicity of the solvent, Dimethylformamide (DMF), and challenges in obtaining micrometer- and nanometer-sized crystals. Limitations included difficulty in integrating with flexible substrates such as PET (Xu et al. 2021)

In the discussion, the potential to modify the optoelectronic and PL properties of the crystals by changing their size, shape, and color was highlighted. However, the study was limited by the lack of nanometer-sized crystal growth, and future work should include AFM imaging and PL and Raman characterization of such crystals.

In conclusion, this study demonstrates the potential for modifying the properties of lead-free perovskites by adding nanoparticles and using laser processing.

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PROCESSING OF HEAVY DIESEL FRACTION ON A ZEOLITE CATALYST

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The compounds that have the most significant effect on the solidification of diesel fuel are n-paraffins. Due to the changing in the structure of paraffins, specifically their transforming into iso-paraffins, as well as other classes of organic compounds, it is possible to reduce the low-temperature characteristics of diesel fuel. Such processes can be implemented using zeolite catalysts. In addition, the technology for producing low-freezing diesel fuel on a zeolite catalyst does not require expensive metals and hydrogen-containing gas [1]. However, cracking reactions actively proceed on zeolite catalysts, which increases the yield of gaseous and light hydrocarbon non-target products. One way to reduce the yield of this kind of non-target products is to adjust the composition of the feedstock used for processing.

This work is devoted to the studying and comparison of the physical and physicochemical properties of heavy diesel fuel (boiling point is 240 °C) and products of its processing on a zeolite catalyst. For the feedstock and the resulting products, in accordance with the requirements [1], such characteristics as density, viscosity, sulfur content, cloud point (Cp), pour point (Pp), cold filter plugging point (CFPP) were determined. The results are presented in the table.

The results, which was shown in the table make it possible to judge that the processing of the heavy diesel fraction on a zeolite catalyst can significantly improve such characteristics as CFPP, cloud point, and pour point. The resulting product also contains significantly less sulfur. The density of diesel fuel does not go beyond 833.5 kg/m^3, therefore, it meets

Table 1. Comparison of the characteristics of the origin fraction and the products of its processing

Characteristic	Fraction 240 °C-EBP	Product 240 °C-EBP
Density at 15 °C, g/cm^3	0.830	0.824
Density at 20 °C, g/cm^3	0.827	0.821
Kinematic viscosity at 15 °C, mm^2/s	8.291	3.038
Kinematic viscosity at 20 °C, mm^2/s	7.144	2.692
Sulfur content, mg/kg	924	340
Cp, °C	–9	does not become cloudy
CFPP, °C	–12	–61
Pp, °C	–19	does not freeze at –80
Yield of liquid product, %	–	90.7

the established requirements for arctic diesel fuel, the same can be said about the kinematic viscosity.

In [2], a wide straight-run diesel fraction was used as a feedstock (boiling range 134-342 °C). Distillation temperature of 10 % vol. of the product obtained at a process temperature of 375 °C was 123 °C, 20 % vol. was 162 °C. In this work, when using of heavy diesel fraction, the distillation temperature of 10 % vol. of the product obtained at a process temperature of 375 °C was 135 °C, 20 % vol. was 159 °C. In addition, the yield of a liquid product when using a weighted feedstock decreased from 96.7 to 90.7 % by volume, which indicates the inadvisability of weighting the feedstock of the process. However, it also indicates the possibility of obtaining low-freezing diesel fuel by processing even heavier feedstock on a zeolite catalyst.

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PREPARATION AND STUDY OF NANOCOMPOSITE PHOTOCATALYSTS BASED ON $BiVO_4$

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Photocatalytic technology has attracted extensive attention due to its ability to utilize inexhaustible solar energy for water splitting, pollutant degradation and carbon dioxide reduction. Semiconducting photocatalysts play a vital role in the photocatalytic reaction process, and various types of efficient materials have been developed and investigated for decades. Among these photocatalysts, bismuth vanadate ($BiVO_4$) is a novel photocatalytic material with a narrow bandgap, low toxicity, and excellent chemical stability, thus it is considered as a promising material for the visible-light-driven processes. However, low-efficient charge transport, fast recombination of photogenerated electron-hole pairs, and low adsorption capacity also limit the photocatalytic performance of $BiVO_4$. One of the best methods to increase the photocatalytic activity of $BiVO_4$ is the design of composite photocatalysts to form a heterojunction. A good candidate for making composites is nitrogen-doped titanium dioxide (N-TiO_2), which also has a high stability, possesses safety as commercial TiO_2, and exhibits high photocatalytic activity under visible light. Nevertheless, the quantum efficiency of N-TiO_2 in the visible region needs to be increased to better utilize the energy of sunlight. In this work, a combination of