



## Characterization and catalytic activity of Ni/mesoporous aluminosilicate HMS and Mo/mesoporous aluminosilicate HMS in the conversion of n-hexadecane

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### ABSTRACT

Mesoporous aluminosilicate HMS was synthesized and adopted as a support for Ni and Mo-containing catalysts. Characterization of various samples was performed through XRD and DRIFT techniques. Textural and morphological characteristics were examined using nitrogen adsorption/desorption isotherms. The presence of a mesoporous and ordered structure in the aluminosilicate and catalysts based on it is confirmed by the data of low-temperature adsorption/desorption of nitrogen and X-ray diffraction. A correlation was established between the structural, acidic and catalytic properties of HMS-based catalyst samples. The catalytic activity of Ni/HMS-H-bentonite and Mo/HMS-H-bentonite was investigated during the conversion of n-hexadecane. It was shown that the sample of molybdenum-promoted HMS-based catalyst possesses the highest activity and selectivity in the process of hydroisomerization of n-hexadecane under optimal conditions (320 °C, 1 h<sup>-1</sup>). The yield of isoparaffins on this sample is 42 wt% with a selectivity of 91%.

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### 1. Introduction

In 1959, hydrocracking, a new catalytic process, began to be used in the industrial practice of foreign refineries. The licensor of this process is Chevron. Both processes, hydroisomerization and hydrocracking of long-chain alkanes, play a key role in the petrochemical industry, in which heavy distillates and oil residues are converted into more valuable products, such as gasoline, jet fuel, other middle distillates and lubricating oils [1]. The branching of the alkanes chain during the process of hydroisomerization is one of the ways to increase the octane number of gasoline and improve the performance of diesel fuel at low temperatures [2,3]. This is especially true for Kazakhstan with a sharply continental climate and low air temperatures in winter, sometimes reaching

even –50 °C. Indicators such as pour point, freezing point, viscosity and viscosity index are significantly improved with the introduction of side chains along linear hydrocarbon chains [2,3]. Today, about 90% of all industrial chemical products are produced using bifunctional catalysts [2–5]. This is also applicable to the process of hydroisomerization of diesel oil fractions, since the bifunctional catalyst allows combining the hydrogenating-dehydrogenating functions of metal centers and the isomerizing functions of acidic centers, which are responsible for the rearrangement of the carbenium ion [2,6].

Currently, in the oil refining industry of our Republic, mainly Pt-containing catalysts based on synthetic zeolites are used. A significant disadvantage of this type of catalysts is the diffusion limitations of the transport of large molecules in their porous system, leading to a decrease in the selectivity of the process for poly-branched isoalkanes [2,6,7]. A solution to this problem can be found by creating catalysts based on mesostructured aluminosilicates, which make it possible to convert the higher normal alkanes that

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