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Conversion of extra-heavy Ashal'chinskoe oil in hydrothermal catalytic system

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Abstract

© 2014 Pleiades Publishing, Ltd. The products of hydrothermal catalytic conversion of extra-heavy Ashal'chinskoe oil at temperatures of 210, 250, and 300°C in a closed system with different amounts of water in the presence of the natural catalyst iron oxide (hematite) have been studied. It has been shown that the degradation of high-molecular-mass components of the extra-heavy oil, such as benzene- and alcohol-benzene-extractable resins and asphaltenes, leads to a generation of new light fractions that were absent in the initial crude oil. A difference between the oil components in stability to the conversion processes has been shown. The most significant changes are observed for the reduction in the amount of alcohol-benzene resins, which is accompanied by an increase in aromaticity and the extent of oxidation. In asphaltenes, the concentration of free radicals (R) increases and the concentration of tetravalent vanadium (V^{+4}) decreases, changes that are accompanied by enhancement of structure carbonization and a reduction in their molecular mass. It has been shown that coking includes the step of formation of asphaltenes followed by the conversion of a part of them into high-carbon-content toluene-insoluble substance of the carbene and carboid type, which precipitate together with coke from the petroleum disperse system when a certain concentration is reached. Changes in the structure of the hematite catalyst has been also revealed.

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Keywords

asphaltenes, coke, composition, conversion products, extra-heavy oil, hematite, hydrocarbons, properties, thermocatalytic transformations