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Conversion of Heavy Oil with Different Chemical Compositions under Catalytic Aquathermolysis with an Amphiphilic Fe-Co-Cu Catalyst and Kaolin

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Abstract

© 2018 American Chemical Society. The physical simulation of heavy oil catalytic aquathermolysis with different chemical compositions from deposits located in the Tatarstan Republic, Russia (Ekaterinovsky oil, B2 type, and Olimpiadovsky oil, A1 type), was designed. The catalytic aquathermolysis processes were conducted at a temperature of 300 °C in the presence of a rock-forming additive - kaolin (the content of montmorillonite was 44%), and catalysts composed of transition metal (Fe, Co, and Cu) carboxylates. The environment of the processes was a mixture of carbon dioxide and water vapor. The distinctive features of hydrothermal-catalytic conversion of various oil types are evaluated by fractional, structural-group, microelement compositions, and H:C ratio changes. These variations are due to initial properties of crude oils and the activation degree of destruction reactions on C-C, C-N, C-O, and C-S bonds leading to different levels of increase of saturated fractions content and decrease of resins and asphaltenes content in the products of experiments. By the thermal analysis method, the assessment of potential content of the oil on a solid sorbent before and after experiments was carried out. The high-molecular-weight components of the naphthene-aromatic B2 type oil revealed greater adsorption capacity to the rocks, in comparison with the oil of the A1 type. Therefore, the adsorption of catalyst components on rocks is also greater.

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