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Geothermal conversion of organic matter in the carbonaceous medium in the presence of homogeneous oxidation catalysts

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IN THE CARBONACEOUS MEDIUM IN THE PRESENCE OF HOMOGENEOUS
OXIDATION CATALYSTSS. M. Petrov^{1,2}, D. A. Ibragimova^{1,2}, A. G. Safiulina¹, B. Tohidi², A.V. Vakhin², R. C. Okekwe¹,Karalin E.A¹¹Kazan National Research Technological University²Kazan Federal UniversityE-mail: aliyahanova@mail.ru

ABSTRACT

The work is based on the modeling of geothermal transformations of hydrocarbons in oil-bearing formations of deep horizons of the earth's crust - under abnormally high pressure, in the presence of aqueous fluid and carbonaceous substances. The pressure and temperature in the experiments are typical for water in the supercritical state. The regularities of the conversion of heavy oil in supercritical water and in the presence of finely dispersed caustobioliths and metal oxides were shown. Aquathermolysis in the presence of proton provides blockage of free radicals of high-molecular weight hydrocarbons and saturation of unsaturated hydrocarbons, produced by cracking reactions, and inhibiting of condensation reactions of aromatic macromolecules. The hydrogen protons also promote hydrogenation reactions in the crude oil. The regularities of changes of the component, structural-group, fractional and elemental compositions of heavy oil during the conversion under the above conditions were established, rheological characteristics of the initial crude oil and converted oil were studied as well. As a result of carrying out aquathermolysis in the supercritical water environment and in the presence of initiating additives, the high-molecular weight components of the initial crude oil were degraded with the formation of light distillate fractions, which were scarcely present in the initial crude oil. Thus, the conversion rate for various samples amounted to 18-29%. It resulted in the significant reduction in the viscosity of the converted oil, up to 96% compared to the initial crude oil.

Key words: aquathermolysis, heavy oil, supercritical water, caustobioliths, nanoparticle, iron oxide, component composition, initial crude oil, converted oil, rheological curve.

INTRODUCTION

Study of conversion of hydrocarbons in the supercritical water environment is nowadays at the stage of collecting experimental data [1]. Therefore, it is difficult to state clearly the interrelation between composition and structure of the initial crude and physic-chemical

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