

DETERMINATION OF THERMO-KINETIC PARAMETERS OF DECOMPOSITION OF HEAVY OIL

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It should be noted that in the world there is a tendency of reducing of traditional hydrocarbon reserves including classical oil. In this regard, much attention is paid to the search for effective methods of processing of heavy high-viscosity oils. For carrying out thermal, thermocatalytic and hydrogenation processes it is necessary to have empirical values of thermokinetic parameters of these processes determined by the method of thermogravimetry.

Experimentally determined thermo-kinetic parameters of thermal decomposition of heavy oil of field Karazhanbas of the Republic of Kazakhstan in the presence of Fe₃O₄ nano-catalyst, catalytic additives (microspheres obtained from the ash of coal, nickel catalytic additive on the microspheres) and polymers as hydrogen-donors (polyethylene glycol, polystyrene). The method of thermogravimetry was applied in an inert atmosphere of nitrogen. The dependence of the thermo-kinetic parameters of heavy oil decomposition from the presence of nanocatalysts, catalytic additives and hydrogen-donors in two ways: by the method of T.V. Bukharkina [1] and method of Professor A.M. Gulmaliev [2].

Thermogravimetric curves of mass loss and rate of mass loss in an inert atmosphere for high-viscosity oil (HVO) are shown in Fig. 1.

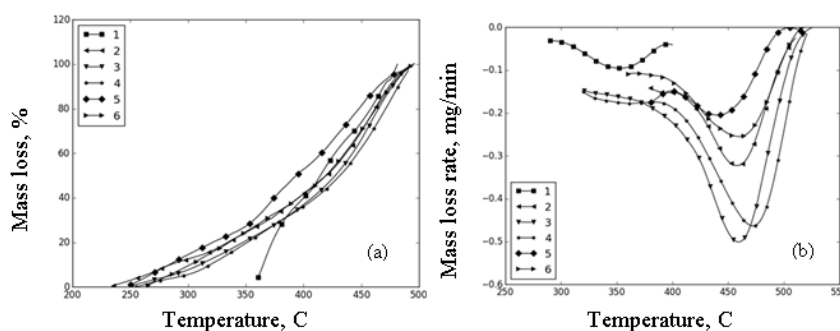


Figure 1. Thermogravimetric curves of mass loss (a) and mass loss rate (b) for high-viscosity oil: 1 – high-viscosity oil, 2 – HVO in the presence of polystyrene, 3 – HVO in the presence of polystyrene with nanocatalyst Fe₃O₄, 4 – HVO in the presence of polyethylene glycol, 5 – HVO in the presence of polyethylene glycol with NiO/microsphere, 6 – HVO in the presence of polyethylene glycol with microspheres.

According to the values of the activation energy, it can be judged that the process of decomposition of high-viscosity oil takes place in the diffusion-kinetic and kinetic regions.

Comparison of the methods of T.V. Bukharkina and A.M. Gulmaliev show that they complement each other, using the first method allows to find a pre-exponential factor and the activation energy, and to determine the kinetic parameters in a narrow temperature range, and the second method allows to determine the rate constants of the processes.

References

1. Bukhareva O.Ph., Bukharkina T.V., Kinetics and Thermochemistry of the Processes of Thermal Decomposition of Carbon-containing Substances. M.: D.I. Mendeleev RChTU, 2001. 28 p.
2. Gul'maliev A.M., Golovin G.S., Gladun T.G., Theoretical Foundations of Coal Chemistry. M.: Publishing House of the Moscow State Mining University, 2003. P. 385.