Mathematical modeling of in-situ combustion as a method of enhanced oil recovery

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One of the most promising methods for enhanced oil recovery is thermochemical, which is characterized by the injection of a heated displacing agent (for example, a mixture of gas and water) into the reservoir. Heated oxygen or air reacts with the hydrocarbon, resulting in its oxidation with the release of heat; The products of the chemical reaction are carbon dioxide and water vapor. This reaction is exothermic, the temperature of the fluid rises, and the viscosity drops, as a result of which the process of oil displacement from the reservoir is accelerated. In the case when chemical reactions occur between the displacing and displaced phases, the displacement instability begins to have a great influence on the process, since the area of the contact surface between the reacting substances increases. Therefore, it is important to take into account instability when modeling such processes. The paper presents a mathematical model for modeling a multiphase flow through a porous medium, taking into account chemical interactions between phases, as well as taking into account the instability of the displacement front. The results of numerical simulation are presented. The efficiency of the thermogas method of oil recovery is shown. The author would like to acknowledge the support by the Russian Science Foundation (Grant initiative 22-21-00236)