Features of Saturates Mixture Filtration in Porous Medium

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Multi-phase filtration processes in porous media are naturally widespread. In this work results of methane series hydrocarbon mixture filtration research in porous media are represented. Interest of such mixtures is caused by necessary of gas-condensate extraction process increase. Gas-condensate is a valuable raw which consists of methane and its higher derivatives. Naturally oscillation flow regimes are occurred during gas-condensate recovery. The cause of these oscillations was unknown.

Our investigation has shown that filtration characteristics of such mixtures are responsible for retrograde condensation region presence at the phase diagram of the mixture. In this region liquid phase accumulation occurs under constant temperature and pressure decrease below critical. Experimental research of mixture filtration has been carried out on the set-up ”Plast” disposed in JIHT RAS. Oscillation flow regime with period depending on pressure drop, mixture composition and porous medium characteristics has been discovered. Mathematical model of methane series hydrocarbon mixture filtration under constant temperature has been created. It was considered that fluid flow regime is laminar and phase pressures are equal under phase equilibrium condition (characteristic time of phase transition is far less than hydrodynamic characteristic time). The studies have shown the possibility of the self-oscillation regime existence in the process of hydrocarbon mixture filtration. Necessary condition for self-oscillations is locating the system in a retrograde region at the phase diagram. Presence of areas in which phase permeabilities are much different is the basis for implementation of the self-oscillation system feedback coupling. Self-oscillation system parameters with given porous medium properties is uniquely determined by the boundary conditions for pressure and methane mole fraction.

Consequently, some hydrocarbon mixtures (or other two-phase systems with retrograde regions) behave as a self-oscillating system in filtration process through porous medium. Account of the self-oscillation regime occurrence possibility must be taken when impact method on natural gas-condensate systems for raw yield increase is being chosen.