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Investigation of the Gas Injection Effect on Asphaltene Onset Precipitation Using the Cubic-Plus-Association Equation of State - DTU Orbit (08/11/2017)

Investigation of the Gas Injection Effect on Asphaltene Onset Precipitation Using the Cubic-Plus-Association Equation of State

Miscible and immiscible gas flooding is one of the enhanced oil recovery (EOR) techniques that has been widely used to increase the oil production. One of the critical problems with gas flooding is that it generally aggravates the asphaltene precipitation, which further creates a flow assurance problem. Therefore, it is imperative to investigate beforehand the effect of gas injection into the reservoir from the modeling results. The cubic-plus-association (CPA) equation of state (EoS) has previously been applied to model the asphaltene onset precipitation condition. In this work, we adopt the modeling approach from the previous work and provide the conceptual base for it. Five different reservoir fluids are studied to validate whether the model is able to calculate the effect of different types (e.g., N2, CO2, and methane) and amounts (e.g., 10, 20, and 30 mol %) of gas injections in agreement with experimental data from the literature. We also investigate the model behavior to show the importance of the association term in the EoS for the selected modeling approach. Sensitivity of the model results when we calculate either two or three model parameters from the experimental data is also studied. Model dependency upon the saturates, aromatics, resins, and asphaltenes (SARA) analysis or molecular weight (MW) of asphaltene is also analyzed. In addition, a unique characteristic of the model for the given stock tank oil (STO) is identified, which does not change with different types and amounts of gas injections and also remains the same at upper and lower onset pressure boundaries. On the basis of this unique characteristic, a simple procedure to predict asphaltene phase envelope (APE) for the reservoir oil with relatively simple and few experimental data, performed on STO with n-pentane/n-heptane as a precipitant, is proposed. This proposed procedure avoids the need of high-pressure measurements of upper onset pressure (UOP).

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