

Performance Prediction of Foam Assisted Steam Flooding Application in a Sandstone Reservoir

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Abstract

The steam assisted foam flooding (FASF) technique was innovated to improve the sweep efficiency of the steam flooding processes in heavy oil reservoirs. Steam flood or steam drive that is not stabilized by gravity can result in poor vertical and horizontal sweep efficiency as a result of many factors such as; poor vertical conformance in the injectors in heterogenous reservoirs, high permeability streaks or thief zones and high reservoir pressure with large wells spacing.

As a solution to these issues, the reduced mobility of steam using steam assisted foam flooding technique can contribute in increasing the pressure gradients in the steam swept regions and/or channels leading to better displacement of the heated oil. In addition, it works to divert steam to the unheated left-behind viscous oil and heat it to flow easier to the production wells. In this work; FASF was modeled in a heavy oil sandstone reservoir in Oman. The simulation was done using CMG software. The work was conducted using a representative reservoir sector model that is satisfactorily initialized and history matched using actual field production data. After that, the base case scenario was forecasted. Then, FASF was introduced to the model by using an empirical foam model. Using the modified model, FASF performance was predicted successfully and then it was compared to the base case scenario. Finally, sensitivity analysis were done to evaluate the optimum mobility reduction effect, mole fraction of injected foam and the suitable blockage factors for the given field was predicted.

The results showed a positive impact on the predicated recovery factors and the overall performance. Recovery factors increased by 4% when using FASF which will have a significant impact on the economy of the project by adding 3.7 million bbl. oil production in the prediction period. The resulted average reservoir temperature increased approximately by 10 °F. Steam to oil ratio showed a sudden reduction after using FASF technique which reflects the improvement in vertical and horizontal sweep efficiency. FASF optimum injected mole fraction and blockage factor where optimized and analyzed for the given reservoir. The overall performance predicted for the given reservoir is satisfactory and there are research potential especially related to the experimental work needed to calibrate the model and model the generation-destruction of foam in the reservoir.