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Proceedings

Foamy behavior assitedcyclic solvent-gas-steam-coinjection

Proceeding

Cyclic solvent-gas-steam-coinjection has been successfully demonstrated in experimental study and filed applications. However, a systematic examination of the impact of foamy oil flow on the performance of cyclic solvent-gas-steam-coinjection has not been reported. This paper presents an experimental study that addresses this issue.

The mixture of solvent (CO_2) and gas (N_2) with different proportions is firstly compounded, and then the mixture was injected into a sand pack, which was saturated with heavy oil at several different temperatures and different pressure, to get fixed fluids. The obtained fluids from the sand pack can be observed in a high-temperature-high-pressure glass micro model to testify the existence possibility of foamy oil. Finally, the ability of foaminess and the production performance under different soak time and back pressure were studied by conducting parallel cyclic solvent-gas-steam-coinjection experiments.

Under high power magnification with reflected light, pictures obtained from a large area of the visualization model reveal the presence of foamy oil flow in thermal-recovery condition. The results show the lower the temperature is, the higher stability of bubble is. However, oil bubble can be obtained under high temperature at 120°C, and the bubble is approximately 67micrometers in diameter. The color of the crude oil in the visualization model turns brown or coffee from the original deep black. The mobility of crude oil gets greatly improved.

The foamy behavior can also be obviously observed from the produced liquids during cyclic solvent-gas-steam-coinjection experiment. The production performance varies with soak time change. The shorter the soak time is, the less the number of the oil bubble is. Oil-recovery efficiency gradually increases with the increase of soak time, and then remains flat. The experimental results also explicated that wellhead back pressure was the most important parameter that altered the flow behavior and foaminess. The larger between the injection pressures and back pressure is, the more the number of the bubble is and the higher the production rate is.

The foamy behavior can be observed at an intermediate temperature in thermal recovery condition. Rational soak time and effective back pressure control during cyclic-steam-solvent-gas-coinjection provides a favorable condition for generation of foamy oil. The foamy behavior during huff and puff actually achieve a better production performance.

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Conflict of interest

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