The Roles of Fluid Properties, Half-Cycle Slug Size, and Timing of Cyclic Injection on Water Alternating Gas Injection Performance in Near-Miscible and Miscible CO_2 Flooding

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The overall goal is to experimentally study the effects of fluid properties (brine salinity and gas composition), CO_2 and water half-cycle slug size (HCSS), and timing of cyclic injection on the performance of Water Alternating Gas (WAG) injection in near-miscible and miscible conditions.

The effects of CO_2 and water HCSS and miscibility conditions on WAG performance in tertiary CO_2 flooding have been investigated. A crude oil from Cottonwood Creek field in Wyoming is used. The core flooding experiments in Berea sandstone core are conducted at 60°C. Alternate cycles of CO_2 and brine with a WAG ratio of 1:1 are injected with HCSS ranging from 0.05 to 0.75 pore volumes (PV). In the study of the effect of HCSS, the experiments are performed at miscible condition. It is found that there is an optimum HCSS, by which the CO_2 utilization factor reaches a minimum value. It means that WAG with an optimum HCSS requires the least amount of CO_2 to produce one barrel of oil. At this optimum HCSS, the tertiary oil recovery also reaches a maximum value. In the study of the effect of miscibility conditions, two more miscibility conditions are investigated. The HCSS study is repeated for near miscible condition and immiscible conditions. Immiscible flooding does not perform as well as near miscible and miscible flooding, but near miscible and miscible flooding perform comparably in water wet system, which demonstrates that requiring miscible condition could be overdesign. A consistent optimum HCSS is also observed.