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, and timing of cyclic injection on the performance of Water Alternating Gas (WAG) injection in near-miscible and miscible conditions.

The effect of salinity of the injection brine on WAG performance in tertiary miscible CO_2 flooding has been investigated. The core flooding experiments in Berea sandstone core are conducted at 60°C and at miscible condition, i.e., 20% above the minimum miscible pressure of the oil sample. A model oil and a crude oil from Cottonwood Creek field in Wyoming are used. Six alternate cycles of brine and CO_2 with a half-cycle slug size of 0.25 pore volumes and a CO_2/water volume ratio of 1:1 are injected in every core flood test. At the same miscible condition, the tertiary recovery factor of WAG is demonstrated to be higher than that of continuous CO_2 flooding, i.e., to recover the same amount of oil, WAG flooding requires less volume of CO_2 than continuous CO_2 flooding. The tertiary oil recovery and recovery factor of both model and crude oils are found to increase slightly with the salinity of the injection brine due to the decrease in the CO_2 solubility in brine. The $CaCl_2$ in the injection brine is found to have similar effect as NaCl.