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 of this project is to experimentally study the effects of fluid properties, 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 timing of cyclic injections on WAG performance in miscible CO_2 flooding have been investigated. A crude oil from South Slattery field in Wyoming is used. The core flooding experiments in Berea sandstone core are conducted at the formation temperature of South Slattery field, i.e., 57°C, and at miscible condition, i.e., at a pressure of 2960 psi (20% above the minimum miscible pressure of the oil sample). WAG injection is introduced at different stages of water flooding, i.e., when secondary water flooding recoveries (WFR) are 0%, 20%, 40%, and 55% of original oil in place (OOIP). Ten cycles are injected with an HCSS of 0.1 PV and a WAG ratio of 1:1. The results show that injecting WAG too early or too late results in either low macro sweep efficiency or low micro displacement efficiency. The best timing to inject miscible CO_2 WAG is when the water flood front roughly passes through the middle of the core, i.e., when water flooding has produced roughly half of the oil that could be recovered by secondary water flooding. By using the best timing, the oil recovery achieves an optimum value.