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# Insight into Influence of Crossflow in layered Sandstone porous media during Miscible and Immiscible CO2 WAG Flooding

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For the layered system, cross-flow is one of the mechanisms for recovery enhancement during an IOR/EOR process. Thus, the results from this paper are very important to overcome the current challenges in capturing the importance of cross-flow influence as well as mitigating the effect of geological uncertainties on current and future IOR/EOR projects.

This manuscript presents the results of an experimental investigation into the effect of cross-flow on ultimate oil recovery during miscible and immiscible CO2 WAG flooding in layered sandstone porous media. A manufactured core sample constructed by attaching two half-cylindrical homogeneous natural sandstone plugs of different permeabilities. The core flooding tests using n-Decane Synthetic brine CO2 were conducted at a constant temperature of 343 K and under two different pressure conditions, namely, 9.6 MPa and 17.23 MPa to attain both immiscible and miscible conditions, respectively.

The results indicated that cross-flow in the layered sample has a negative impact on the ultimate oil recovery (i.e. decreasing oil recovery factor). The degree of heterogeneity seems to strongly influence the effectiveness of cross-flow during CO2 EOR with the oil recovery decreases as the permeability ratio (PR) between the two half plugs included in every samples increase. For instance, during miscible CO2 WAG flooding, a decrease in incremental oil recoveries from 3.3% to 11.3% and eventually to only 4.8% occurred when the permeability ratios were increased from 2.5 to 5 and 12.5, respectively. Similarly, during immiscible displacement, the recorded oil recoveries were 6.1%, 6.9% and 4.7% reflecting the same increases in permeability ratios as above. These results revealed that cross-flow works against the influence of the dominant active forces. For instance, in non-communicating layers, the dominance of viscous forces prevailed while there is a preferential flow path exists in flow in communicating layers. However, with increasing permeability ratio a considerable channelling of CO2 into the high permeability layer leaving the low permeability layer touched partially, implying that heterogeneity in vertical direction indeed significantly affects remaining oil saturations, thus oil recovery.

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