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# Experimental Investigation of Relative Permeability Curves in Oil/water Transition Zone of Tight Sandstone Reservoir

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The oil/water transition zone contains a significant portion of original oil in place (OIP) especially for those tight sandstone formations with rather small pore diameter and high capillary pressure. As the buoyancy balanced with the capillary force, the water saturation changes from 1.0 at the free water level to the irreducible water saturation at the top of the transition zone. Accordingly, both oil and water are mobile in the transition zone. A better understanding of the mechanism of how oil and water flow in the transition zone depends on the relative permeability data. However, traditional single relative permeability curve cannot provide enough information. Considering the characteristic of the transition zone, the impact of initial water saturation on the oil/water relative permeability curves need to be solved.

To solve the question above, a laboratory study was conducted to measure a set of oil/water relative permeability curves with different starting water saturation on reservoir core plugs from Changqing oilfield in China at the underground condition. The experiments take brine as the aqueous phase and silicone oil as the oleic phase. For the time consuming of the steady method, the unsteady method is cindered. The core samples were first saturated at residual water saturation to measure the bounding oil/water relative permeability curve. Then, the core samples were saturated at different initial water saturation to simulate different initial conditions in the transition zone and measured different scanning oil/water permeability curves. For the data processing, the JBN method is applied with a modification considering the capillary force. Finally, the impact of initial water saturation on the oil/water relative permeabilities were analyzed.

The experimental results revealed that the oil/water relative permeability curves with different initial water saturation vary differently. For the water is the wetting phase, the residual oil saturation reduces as the initial water saturation increases. The reason is that as the water saturation increasing, the wetting phase tends to occupy smaller throats and pore walls in the formation, leaving larger pores for the oil phase, which makes the oil phase displaced easily. The permeability curves gradually move towards right, and the movable water area narrows with increasing starting water saturation. Both the bounding relative permeability curves and scanning permeability curves have nearly the same shape.

The relative permeability data provide essential information for accurately simulating the production performance of the transition zone. However, the conventional reservoir simulation does not consider the initial water saturation factor into account and resulted deviation in simulation and actual field performance in oil/water transition zone. In conclusion, a set of oil/water relative permeability curves has essential impact on the field performance predictions for reservoir transition zone.

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## **Country**

China

## **References**

## **Time Block Preference**

Time Block C (18:00-21:00 CET)

## **Participation**

Online

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