Comparison of Geophysics- and Core-based Wettability Assessment Methods: An Experimental Study using Artificial Grain Packs

Zulkuf Azizoglu and *Zoya* Heidari

The University of Texas at Austin, 78712 200E Dean Keeton St, Austin, TX, USA

Abstract. Conventional methods for wettability assessment are time-consuming and subject to non-uniqueness. We recently developed wettability models based on 2-dimensional Nuclear Magnetic Resonance (2D-NMR) and/or electrical resistivity measurements to address the aforementioned limitations. However, these methods require core-scale verification, which has been challenging due to the uncertainties in wettability distribution inside the core samples as well as lack of a reliable ground truth for wettability of a given sample. The objectives of this paper include (a) creating cylindrical synthetic rock models with controlled and wide range of wettability, (b) measuring 2D-NMR and resistivity responses in the synthetic samples, and (c) evaluating the performance of the new geophysics-based wettability models. We aggregate glass beads of different wettability levels to create cylindrical artificial grain packs with controlled wide range of wettability. Then, we alter water saturation and perform the aforementioned geophysics-based measurements. Results demonstrated that water saturation and wettability can be simultaneously estimated by integration of 2D NMR and electrical-resistivity measurements with average relative errors of less than 15% and 20%, respectively. We observed up to 50% relative difference in USBM indices and the fraction of water/hydrocarbon-wet beads. The outcomes of this work shed light on the reliability of different wettability quantification models/workflows.