ELECTRICAL PROPERTIES OF SHALES

Abstract:

The determination of water saturation based on electrical resistivity logs relies on knowing the electrical properties of the reservoir rocks. However, measurements of these electrical properties for unconventional shale reservoirs are scarce in the literature. This scarcity increases uncertainties of water saturation estimates and prevents reliable hydrocarbon reserves estimations.

To improve water saturation estimates and understand the factors controlling electrical properties such as the Archie cementation exponent (m) and structure factor (a) in shales, we measured the electrical resistivity of 95 brine saturated unconventional shale samples collected from the immature, oil and gas windows of the Woodford and Wolfcamp shales. These samples were characterized by measurements of petrophysical properties such as TOC, mineralogy, and crushed rock porosity. In addition to these measurements, we have also modeled the flow of electrical current through porous media.

Modeling of electrical current flow through porous media revealed that the structure factor is a universal constant equal to 1. Measurements of resistivity on the brine saturated samples revealed that maturity exerts a minor control on the cementation exponent. The strong linear relationship between TOC and cementation exponent allows the computation of cementation with the knowledge of TOC.

Bio:

Ali Tinni is a faculty in the Petroleum Engineering Department of the University of Oklahoma. His current research interests include fluid flow and storage as well as EOR in unconventional reservoirs. He holds Master's and PhD degree in Petroleum Engineering from the University of Oklahoma.