Improvement and Analysis of Current NMR Permeability Models with Core NMR Measurements

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Abstract

The most common methods of predicting permeability from NMR spectra are Timur-Coates and SDR. Both of these methods do give trend of prediction of permeability, but with very large average relative error in the reservoirs we are studying, especially in low permeability reservoirs. One possible reason is that the porosity calculated from NMR data is usually lower than the true value. Another reason is that these models are dependent on T2 cutoff values but many researchers have shown T2 cutoff to be variable with measurement situations and is a function of lithology.

This paper focuses on several case study reservoirs that have very wide range of permeability (from 0ver 9000 md to 0.001 md). By comparing NMR spectra at fully saturated and irreducible water conditions, T2 cutoff values are obtained and permeability is predicted using different models from the literature. We assessed that the various differences between NMR permeability from current models and core data and what causes the differences on the permeability determination. We found that the current method of determination of T2 cut off value can affect T2 cut off values and, consequently, the prediction of NMR permeability because the comparison of NMR spectra at fully saturated and irreducible water conditions is not always consistent at BVI range on T2 spectra. Therefore, an attempt was made to analyze the NMR core data using the raw decay files, thus eliminating additional errors from signal inversion and the method of estimates of T2 cutoff values, and correlate the measured data to permeability and Swi.