Estimating the Capillary Pressure of Reservoir Rocks Using Nuclear Magnetic Resonance (NMR) Logging

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Nuclear Magnetic Resonance (NMR) logging is a vital part of modern progressive oil reservoir analysis for efficient oil recovery. Although it already aids in the determination of porosity, saturation, and other physical rock properties, geophysicists believe the use of NMR spectroscopy is yet to be exploited to its fullest potential. The purpose of this research is to study data collections of NMR transverse relaxation time (T2) distributions to correlate them to the mercury-injection capillary pressure (MICP) of sandstone, a reservoir rock sample. The goal is to determine a calculable relationship between the two measurements by understanding and analyzing graph trends and formulating an equation connecting the two values. The procedure used is to take the value of the T2 relaxation time and to correlate it to rock saturation, then to relate that property to the capillary pressure. Capillary pressure, measured by the general equation Pc= Pnw-Pw, is essential in the reservoir analysis and modeling process. This is because it determines the pressure at which the oil or gas naturally exerts from the reservoir rock without any added pressure or enhanced oil recovery. Through this research, with different factors like MICP and lab-evaluated NMR, the trend found that capillary pressure has an inverse relationship with T2 relaxation time and shows an exponential decay. By finding a relationship between NMR T2 and capillary pressure, the mercury-injection method becomes obsolete and petrophysicists can depend entirely on NMR, making the process entirely more efficient and economic.

Awards Won:
Fourth Award of $500