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(G*) Measuring Pore Size in Fluid Saturated Porous Media

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Reservoir rocks which trap oil and gas have been extensively studied for decades, due to their importance in the petroleum industry. Pore size is an important petrophysical property controlling fluid storage and fluid transport in reservoir rocks. Many techniques such as scanning electron microscopy (SEM), X-ray, and mercury injection capillary porosimetry (MICP), have been applied to estimate pore size, however, with some limitations, for example sample size, measurement cost, and sample damage. Magnetic resonance (MR) is a very promising technique for interrogating such samples, because it is non-destructive, non-invasive and sensitive to fluid dynamic and environment.

This presentation will discuss a new direct and rapid one-dimensional MR method to estimate the pore size and surface relaxivity of porous materials. MR signal decay rates, from fluids in the pore space, depend on the pore size, the surface relaxivity and molecular self-diffusion as described by Brownstein-Tarr (BT) theory. In the present work, the correlation between MR relaxation behavior and the temperature-dependent self-diffusion coefficient of pore fluids was employed. The MR relaxation lifetime and the relaxation regime of the samples were shifted due to temperature variation. This shift was used to estimate the pore size and surface relaxivity by nonlinear fitting.
Water-saturated glass bead packs were employed in initial experiments at variable temperature. The calculated pore size matches the estimated geometric pore size. The proposed method was applied to determine the pore size of fluid saturated Berea, Buff Berea and Nugget sandstones. The pore sizes determined with three pore geometries are in good agreement with scanning electron microscopy (SEM) and uCT measurements.

Keyword-1

Magnetic Resonance

Keyword-2

Relaxation lifetime

Keyword-3

Pore size

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