JOINT INVERSION OF NMR DATA MEASURED AT DIFFERENT WATER SATURATIONS

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Nuclear magnetic resonance (NMR) relaxation is a well-established method to characterize storage and transport properties of rocks due to its sensitivity to pore fluid content and pore sizes. Thereby, the correct estimation of these properties depends on the underlying pore model. Usually, cylindrical or spherical pores are assumed for interpreting NMR relaxation data. For estimating their size, a calibration regarding the mineral parameter surface relaxivity is required.

Mohnke (2014) used NMR measurements at different saturations for deriving surface relaxivity and pore size distribution simultaneously without the need for calibration. We extended this approach by using a model of parallel capillaries with angular cross-section to account for residual water trapped in pore corners of desaturated pores. Additionally, we present a method that allows determining the shape of these angular capillaries from NMR data at different drainage and imbibition levels. We show the applicability of our approach on synthetic and real data sets.

Overall, we introduce a method for a direct determination of pore size distribution, pore shape, and surface relaxivity based on NMR measurements at different water saturations without further calibration.