Petrophysical Properties Prediction using Micro Computerized Tomography -A Case study

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The primary tools for reservoir characterization are wellbore logging and core derived laboratory measurements for calibrating field logs and establishing relationships between log responses and the petrophysical properties of cores. A new technology is developed based on the digital image of the rock to supplement the already possessed reservoir characterization tools in the petroleum industry. And this technique is Micro Computerized Tomography (mCT). This technique generates a data set, called a tomogram, which is three dimensional representation of the structure and variation of composition within a specimen. Each three dimension point in the tomogram is called a voxel. The paper discusses this technique to predict rock properties using Micro Computerized Tomography (mCT) on a sandstone reservoir. This technology includes a high resolution X-ray micro-computerized tomography system capable of acquiring images made up of 2048^3 voxel on core plugs maximum up to 5 cm diameter with resolution down to 2-3 micron. The very small sample size required for imaging may allow representative petrophysical data to be obtained from sidewall cores & drill cuttings. As this method requires small sample size of approximately 5mm diameter for maximum resolution and then further numerically making subsets of it required for analysis thus makes it possible to produce multiple measurements on a single plug. This represents a potential multiplier on the quantity of core data allowing meaningful distributions or spreads in petrophysical properties to be estimated. The study is conducted on pay sand having laboratory data determined with average porosity between 16-18 % & permeability 50 to 150 mD. Resolution of the reconstructed mCT image is up to 5.41 micron. Imaged data was processed with well established Feldkamp algorithm based on parallel filtered back projection method. The reconstructed data is then put on with four filters in order namely Anisotropic filter, Unsharp mask filter, Shrink wrap mask filter and Shrink existing mask filter to remove the noise & get a best contrast between different phases. The filtered data is then segmented into two phase data & this image volume is named as binary volume. Computational results made directly on this digitized tomographic images are presented for the porosity profile, pore size distribution, drainage capillary pressure, permeability, conductivity & elastic properties. These computed data is compared with the available Special Core Analysis Laboratory data. The results are in good agreement. The result provides an insight & understanding of a wide range of complex phenomenon in reservoir rocks not previously possible & thus adds value to the reservoir characterization.