Contribution ID: **334** Type: **Poster (+) Presentation**

Pore Connectivity Analysis and Electrical Conductivity Model for Tight Sandstones

Wednesday, 2 June 2021 10:00 (1 hour)

Non-Archie's law phenomenon, where the saturation exponent varies with the water saturation, has been observed for tight sandstones due to bimodal pore size distribution and high clay content. In the study, we proposed a new method to analyze pore connectivity by multi-scale imaging techniques and established dual-porosity conductivity model for tight sandstones. Firstly, broad ion beam scanning electron microscope (BIB-SEM) is applied to acquire 2-D grayscale images with a resolution of 100 nm. Pores and main minerals are identified by image segmentation and cluster labelling algorithm. We classify the pores of tight sandstones into residual intergranular pores and intercrystallite pores that occur in clays. Secondly, dried samples with a diameter of 5 mm are imaged by a micro CT with a resolution of 3 μm. The porosity resolved by the micro CT is far less than helium porosity measured in lab. The resolved pores form isolated clusters due to the absence of sub-resolved throats. The samples are saturated with sodium iodide solution and scanned by the micro CT to obtain 3-D grayscale images. Image registration methods are carried out on the two kinds of grayscale image. We find that the CT-resolved pores are mostly saturated by the solution. Furthermore, part of voxels standing for clay minerals in dried samples is invaded by the sodium iodide solution. It suggests that intercrystallite pores in clays are the main conductive paths in tight sandstones. The large intergranular pores are connected through the intercrystallite pores. Finally, a dual-porosity electrical conductivity model is established according to the result of pore connectivity analysis. The conductivity model of tight sandstones is built by combining series-parallel conductivity theory and W-S argillaceous sandstone conductivity theory. The contributions of fluid in multi-scale pore space and surface conductivity of clay minerals on bulk electrical conductivity are both included. We predict the conductivities of the tight sandstone samples of the Ordos Basin using the dual-porosity model based on the measured porosity, clay content, and NMR T2 distribution. The calculated electrical conductivities agree well with the experimental results.

Time Block Preference

Time Block A (09:00-12:00 CET)

References

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