Contribution ID: **93** Type: **Oral Presentation**

Gas Flow Simulation in Multiscale and Multimineral Digital Rocks of Shale Samples

Thursday, 2 June 2022 09:25 (15 minutes)

The exploration and development of shale gas require accurate characterization of shale samples and modeling of gas flow. Digital rocks have been widely used to characterize the shale samples, predict their petrophysical properties, and understand the pore-scale transport mechanisms in micrometer and nanometer pore systems. Previous studies from numerous geologists have indicated that the shale samples involve multitype minerals and multiscale pore systems. Therefore, such factors must be considered when shale models are constructed and characterized. Nevertheless, the imaging techniques such as X-ray CT scanners and FIB-SEM have to make a balance between high resolution and large field of view. In other words, current 3D imaging techniques either cover the large-scale structures at a low resolution or cover a small region at a high resolution. To address this issue, this study proposes a novel modeling technique (DEM-QSGSA), called process-based modeling, which combines the discrete element modeling method (DEM) and quartet structure generation set algorithm (QSGSA). The proposed technique can generate various types of minerals (such as quartz, feldspar, calcite clay minerals, and pyrite) and pore structures (interparticle pores, intraparticle pores, and organic-matter pores) in digital models of shale samples.

On the other hand, numerous techniques such as the lattice Boltzmann method, molecular dynamics, direct simulation Monte Carol, and pore network modeling have been used to study the transport mechanisms of shale gas. Among them, pore network modeling can precisely characterize the geometric and topological properties of pore space and consider the micro- and nanometer pore systems. However, the previous pore network modeling method cannot take all the mechanisms into consideration. Therefore, this talk will present a new pore network modeling method, which does not only account for the viscous flow, Knudsen diffusion, and surface diffusion, but also consider the shape and multiscale characteristics of pores and throats and phase behavior.

Finally, the gas flow will be simulated by the pore-network modeling method in the multiscale and multimineral digital models constructed by DEM-QSGSA. In order to evaluate the performance of the algorithms, multiple digital models of shale samples were constructed. The modeling accuracy of the methods was tested by comparing the petrophysical properties from the constructed digital models and experimental data.

Acceptance of the Terms & Conditions

Click here to agree

MDPI Energies Student Poster Award

Yes, I would like to submit this presentation into the student poster award.

Country

China

References

Time Block Preference

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

Participation

Online

Primary authors: WU, Yuqi; Prof. LIU, Keyu (China University of Petroleum (East China)); Prof. LIN, Chengyan (China University of Petroleum (East China))

Presenter: WU, Yuqi

Session Classification: MS13

Track Classification: (MS13) Fluids in Nanoporous Media