Contribution ID: **295** Type: **Oral 20 Minutes**

Multi-scale granular porous structure generation and its effect on permeability

Wednesday, 16 May 2018 14:55 (15 minutes)

Multi-scale nature is one of the key features in complexity of rock structures from unconventional resources. Advanced imaging techniques such as high resolution Computed Tomography (CT) and Focused Ion Beam–Scanning Electron Microscopy (FIB-SEM) have shown that these low permeability rocks possess bi-model pores distribution. To characterize the inter-particle and intra-particle pores and their influence on permeability is important for economically imaging unconventional rocks and effectively predicting the rock permeability.

Experiments are powerful in providing direct information and classification of the inter-particle and intra-particle pores, however heterogeneity makes it difficult to distinguish influence of pores at varying scales. To investigate separate influence of inter-particle and intra-particle pores on permeability, numerical generation of multi-scale rock structure and numerical calculation of permeability are necessary.

In this work, a multi-scale porous structure generation method is brought up and the permeability is computed with Lattice Boltzmann Method (LBM). The generation method is based on Random Generation Growth (RGG) method and only particle morphology is considered at present. By assuming that the rock is formed by porous particles, which consist of smaller agglomerated particles, RGG are used under two scales to control the porous particle structure (intra-particles pores) and the entire packing structure (inter-particle pores). Simulation results by LBM are firstly validated with liquid chromatography experiments data. Then individual influence of inter-particle and intra-particle pores is studied in detail. It is shown that intra-particle pores help to improve the structure permeability and with decreasing intra-particle pore size and porosity, the influence of intra-particle pores can be neglected.

References

[1] Liu X, Wang J, Ge L, et al. Pore-scale characterization of tight sandstone in Yanchang Formation Ordos Basin China using micro-CT and SEM imaging from nm-to cm-scale[J]. Fuel, 2017, 209: 254-264.

[2] Xiao D, Lu S, Yang J, et al. Classifying Multiscale Pores and Investigating Their Relationship with Porosity and Permeability in Tight Sandstone Gas Reservoirs[J]. Energy & Fuels, 2017, 31(9): 9188-9200.

[3] Wang M, Pan N. Predictions of effective physical properties of complex multiphase materials[J]. Materials Science and Engineering: R: Reports, 2008, 63(1): 1-30.

[4] Barrande M, Bouchet R, Denoyel R. Tortuosity of porous particles[J]. Analytical Chemistry, 2007, 79(23): 9115-9121.

Acceptance of Terms and Conditions

Click here to agree

Primary authors: Prof. WANG, Moran; Mr LIU, Tong

Presenter: Mr LIU, Tong

Session Classification: Parallel 8-E

Track Classification: MS 1.24: Pore structure characterization and micro-scale effect on fluid flow in unconventional reservoir