Contribution ID: **161**

Type: **Poster**

Lattice Boltzmann simulation of gas flow and permeability prediction in coal fracture networks

Wednesday, 16 May 2018 18:30 (15 minutes)

The cleat or natural fracture system is a dominant factor controlling the permeability of coal seams. Gas permeability and porosity of coal samples with artificially generated fractures are measured under varying effective stress. Based on the experimental results and the Walsh model, fracture width and roughness are estimated. Considering the fracture aperture and roughness, we present a 3D geometry model to reconstruct coal fracture networks on the basis of the Voronoi tessellations. The lattice Boltzmann method (LBM) is applied to simulate fracture flows and to predict the associated permeability. For comparison purposes, simulations in a single fracture are carried out initially. For a single smooth fracture, the results of LBM simulations show a good agreement with the cubic law. For a single rough fracture, the cubic law overestimates the permeability, and it is two to four orders of magnitude higher than the laboratory measurement. The predicted permeability by LBM simulation is in acceptable agreement with laboratory measurement. Furthermore, the flows through the fracture networks with smooth fracture surfaces are simulated. By comparison to the matchstick model, simulation errors are mostly within 30%. Finally, the effects of structure, surface roughness and aperture on flows in fracture networks with rough fracture surfaces are investigated. The present study provides a promising approach to predict the associated permeability and transport characteristics in coal fracture networks.

References

Acceptance of Terms and Conditions

Click here to agree

Primary authors: Dr ZHAO, Yanlong (China University of Petroleum, Beijing, China); Prof. WANG, Zhiming (China University of Petroleum, 102249 Beijing, China)

Presenter: Dr ZHAO, Yanlong (China University of Petroleum, Beijing, China)

Session Classification: Poster 3

Track Classification: MS 2.14: Numerical methods for processes in fractured media