Contribution ID: **174** Type: **Oral Presentation**

A numerical study of CO2-CH4 displacement in shale using Lattice Boltzmann method

Tuesday, 23 May 2023 10:00 (15 minutes)

A large portion of shale gas is stored in the kerogen matrix as an adsorbed phase, responsible for the slow production after primary recovery. During CO2 injection, the preferential adsorption of CO2 over CH4 in the shale organic matrix facilitates the desorption of CH4; therefore, gas recovery can be potentially enhanced. In this study, the Navier-Stokes equation and the advection-diffusion equation are coupled in the Lattice Boltzmann method to simulate the CO2-CH4 displacement in two-dimensional dual-porosity porous media. The Langmuir adsorption kinetics is implemented at solid surfaces for mass exchange between the free space and solid matrix. The adsorbed gas is assumed to diffuse within the solid matrix homogeneously. The coupling scheme is validated by comparing the simulation results with the analytical solutions for mass transfer. A convergence study is performed for the lattice resolution and the number of extended layers at the inlet/outlet. The lattice Boltzmann model is robust and efficient in porous media of irregular complex geometries. Preliminary results show that the CO2-CH4 displacement is controlled by the inter-solid and intra-solid mass transfer as well as the mass exchange rate between them. The gas diffusion coefficient, adsorption/desorption rate constants, and pore geometry can affect the concentration and adsorption evolutions of CO2 and CH4.

Participation

In-Person

References

MDPI Energies Student Poster Award

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

Country

Australia

Acceptance of the Terms & Conditions

Click here to agree

Energy Transition Focused Abstracts

This abstract is related to Energy Transition

Primary authors: Mr WU, Jian (The University of Sydney); Prof. SHEN, Luming (The University of Sydney)

Co-authors: Prof. GAN, Yixiang (The University of Sydney); Dr SHI, Zhang (The University of Queensland); Dr HUANG, Pengyu (CSIRO Mineral Resources)

Presenter: Mr WU, Jian (The University of Sydney)

Session Classification: MS09

Track Classification: (MS09) Pore-scale modelling