



Contribution ID: 738

Type: **Poster Presentation**

## Direct numerical simulation of CH<sub>4</sub> - CO<sub>2</sub> mixture flow in nanoporous media

*Tuesday, 14 May 2024 09:25 (1h 30m)*

CO<sub>2</sub> injection into shale is believed beneficial for both enhanced gas recovery and CO<sub>2</sub> storage. The confined space and strong solid-molecule interactions in nanoporous media lead to different occurrence states of CH<sub>4</sub> and CO<sub>2</sub>, causing the flow of CH<sub>4</sub> - CO<sub>2</sub> mixture in shale to deviate from predictions of continuum models. In this study, we employed a modified pseudo-potential based lattice Boltzmann (LB) model to study gas mixtures in nanoporous media. The mixed equation of state is used to calculate interaction force between gas mixtures. The solid-molecule interaction force is determined by comparing density profiles from LB simulation and molecular dynamics. The proposed method can model the flow of CH<sub>4</sub>-CO<sub>2</sub> mixture in complex topological nanopores with various surface properties. Our results demonstrate that the Langmuir model and BET theory cannot accurately describe the adsorption isotherms of CH<sub>4</sub> and CO<sub>2</sub> in nanoporous media. The transport capacity of CH<sub>4</sub>-CO<sub>2</sub> mixture in nanoporous media is found affected by surface properties. In organic nanoporous media, CO<sub>2</sub> molecules tend to accumulate near the pore surface, hindering their flow compared to CH<sub>4</sub> molecules. In contrast, inorganic nanoporous media facilitate the flow of both CH<sub>4</sub> and CO<sub>2</sub> molecules. We propose a modified apparent permeability model to describe the flow capacity of a CH<sub>4</sub>-CO<sub>2</sub> mixture in nanoporous media.

### Acceptance of the Terms & Conditions

[Click here to agree](#)

### Student Awards

I would like to submit this presentation into the InterPore Journal Student Paper Award.

### Country

China

### Porous Media & Biology Focused Abstracts

This abstract is related to Porous Media & Biology

### References

### Conference Proceedings

I am interested in having my paper published in the proceedings.

**Primary author:** Mr XIE, Chenyue (China University of Geosciences (Wuhan))

**Co-authors:** Mr HUANG, Jingwei (China University of Geosciences (Wuhan)); Mr YIN, Xiaolong (College of Engineering Eastern Institute of Technology,Ningbo); Mr ZHAO, Hui (School of Petroleum Engineering,Yangtze University)

**Presenter:** Mr XIE, Chenyue (China University of Geosciences (Wuhan))

**Session Classification:** Poster

**Track Classification:** (MS13) Fluids in Nanoporous Media