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Coupled multi-phase interactions model for carbon dioxide (CO₂) storage and sequestration using hydrates-forming method in marine sediments

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Green-house gas (GHG) such as carbon dioxide (CO₂) is largely believed to be a primary contributor to the global warming. Thus, the geological CO₂ sequestration has recently received tremendous attention in both scientific and industrial communities due to its potential to limit the climate change. One effective technology is to store CO₂ in the form of hydrates, so-called hydrates-forming method, such that maximizes the storage capacity. The hydrates-forming technology has been utilized to store CO₂ gas within medium materials such as deep-sea marine sediments. However, there is a key scientific issue existing in the formation of hydrates in the marine sediments involving temperature and pressure-dependent behavior including phase transformation, interactions and flow. Especially, CO₂ gas flow process is critical for a commercial purpose and the process is determined by multi-phase interactions of the gas, water and sediment solid skeleton. Here we proposed and perform a systematic study: Theoretical analysis of CO₂ gas flowing in porous marine sediment materials, a geological model of such fluid behavior has been established, a coupled mathematical model considering multiphase (gas, liquid & solid) conditions at varying temperature and pressure. Molecular-level simulations of multi-phase CO₂ were employed to verify interactions between such gases, water and media materials and eventually, an optimized model has been established considering coupled interactions of gases in multiphase field to better describe gas transportation when hydrates forming in the marine sediment. This study is beneficial for capture, storage and sequestration of CO₂ gas by hydrates-forming method.

Biography

Shu-Qing Hao has obtained her PhD degree in Geology Engineering from Jilin University of China in 2007 and she is currently an Associate Professor of China University of Mining and Technology. She had also been a Post-doctoral Researcher at Tongji University, China and as a Visiting Researcher at Monash University of Australia. She is the grantee of Natural Science Foundation of China and more than 7 other scientific funding/projects

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