Soaking effects on CH4-CO2 replacement efficiency in gas hydrates

Jongwon Jung¹, Jaeeun Ryou¹, Joo Yong Lee², Riyadh I Al-Raoush³, Khalid Alshibli⁴, Seung Won Shin¹, and Jae Hyeok Han¹

¹Chungbuk National University, Civil engineering, Cheongju-si, Korea, Republic of
²Petroleum&Marine Division, Korea Institute of Geoscience Mineral Resources (KIGAM), Daejeon, Korea, Republic of
³Department of Civil and Architectural Engineering, Qatar University, P.O Box 2713, Doha, Qatar
⁴Department of Civil and Environmental Engineering, The University of Tennessee, Knoxville, TN 37996, USA

Gas hydrates are potential energy resources which can be formed at low temperature and high pressure. The number of recoverable gas hydrates are limited due to the specific temperature, pressure conditions and technical limitations of gas production. Various production methods have been studied around the world to overcome these technical limitations. Gas production methods from gas hydrates are divided into methods of dissociating gas hydrates and non-dissociating gas hydrates. The dissociation methods including depressurization method, thermal injection method, and chemical inhibitor injection method can decrease in effective stress of the ground due to phase conversion. On the other hand, CH₄-CO₂ replacement method is geomechanically stable because it does not dissociate gas hydrates. Also, CH₂-CO₂ replacement method has the advantage of sequestering carbon dioxide while producing methane. However, CH₄-CO₂ replacement method has the disadvantage such as low production efficiency and understanding kinetics of gas production. In this study, soaking, gas permeability of gas hydrate layer and hydrate saturation are considered in order to promote the production efficiency of CH₂-CO₂ replacement method. Results show that production efficiency increases with the number of soaking process, the higher gas permeability and hydrate saturation. According to the experimental results in this study, the production efficiency can be increased by considering the soaking time, procedure and selecting the proper gas hydrates site.

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