

[JJ] Evening Poster | M (Multidisciplinary and Interdisciplinary) | M-IS Intersection

[M-IS17] Gas hydrates in environmental-resource sciences

convener: Hitoshi Tomaru (Department of Earth Sciences, Chiba University), Akihiro Hachikubo (Kitami Institute of Technology), Atsushi Tani (神戸大学 大学院人間発達環境学研究所, 共同), Shusaku Goto (Institute for Geo-Resources and Environment National Institute of Advanced Industrial Science and Technology)
Tue. May 22, 2018 5:15 PM - 6:30 PM Poster Hall (International Exhibition Hall7, Makuhari Messe)

An increasing number of researches focusing on natural gas hydrates has recently been conducted from the environmental, material, and resource scientific viewpoints. This session aims to share and discuss the latest research results to understand and examine the nature and potential of gas hydrates in the past-present-future of the Earth. Because the researches on gas hydrates are interdisciplinary, broad topics from field and experimental researches, modeling, etc. will be presented in this session.

[MIS17-P03] Equilibrium pressure of clathrate hydrates composed of isotopologue methane

*Yuki Kikuchi¹, Takahiro Ozeki¹, Akihiro Hachikubo¹, Satoshi Takeya² (1. Kitami Institute of Technology, 2. National Institute of Advanced Industrial Science and Technology (AIST))

Keywords: gas hydrate, methane hydrate, equilibrium pressure, stable isotope

Methane is composed of carbon and hydrogen. Because these components have isotopes, $^{12}\text{CH}_4$ (98.9%), $^{13}\text{CH}_4$ (1.1%), and CH_3D (0.013%) exist in nature. Since their molecular weight differs with each other, physicochemical properties of them are also different with each other. Pure methane hydrate is "mixed-gas hydrate" of their isotopologues. Equilibrium pressure of pure methane hydrate was first reported more than a half century ago; however, those of $^{13}\text{CH}_4$ and CH_3D hydrate have not been studied yet. Fractionation of hydrogen isotope during the formation of methane hydrate has been reported by Hachikubo *et al.* (2007) that δD of hydrate-bound methane becomes several ‰; smaller than that of residual methane in the formation process. This result suggests that the equilibrium pressure of CH_3D hydrate is larger than that of CH_4 hydrate. In this study, we measured the equilibrium pressures of CH_3D hydrate and confirmed the difference between them.

Methane hydrate samples were synthesized in small pressure cells (volume: 5mL). Fine ice powder (1g) was put in a pressure cell, and introduced CH_3D (purity: 98%, Taiyo-Nissan). Clathrate hydrate was formed by melting the ice powder at the temperature of 273.2K under high pressure of methane. We also prepared normal methane (purity: 99.99% for methane, but 98.9% for $^{12}\text{CH}_4$, Takachiho Chemical Industry Co. Ltd.) hydrate as a reference, using the same preparation method. These pressure cells were placed in a temperature-controlled liquid bath, and measured their equilibrium pressures from 273.2K to 277.2K.

The equilibrium pressure of CH_3D hydrate was about 0.07MPa larger than that of CH_4 hydrate, and the results agreed with the previous report by Hachikubo *et al.* (2007).

Reference

Hachikubo A, Kosaka T, Kida M, Krylov A, Sakagami H, Minami H, Takahashi N, Shoji H (2007) Isotopic fractionation of methane and ethane hydrates between gas and hydrate phases. *Geophys Res Lett* 34: L21502. doi:10.1029/2007GL030557