

## Development of observation system of gas hydrate forming in the environment simulated near the bottom of icy shell in icy satellites

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Gas hydrates are clathrate compounds where hydrogen-bonded water cages include a guest gas molecule. Methane hydrate is one of famous gas hydrates because it is naturally found in deep-sea and permafrost sediments on the Earth. Gas hydrates would exist in icy moons as well. One of the most likely candidate is Saturn's icy satellite Enceladus. Enceladus has a global ocean beneath the icy shell. INMS (Ion and Neutral Mass Spectrometer) aboard the Cassini spacecraft has investigated composition of the plumes that includes H<sub>2</sub>O (< 90 %), CH<sub>4</sub>, CO<sub>2</sub>, NH<sub>3</sub>, and other various organic materials. These results could reflect the composition of the subsurface ocean and imply the presence of clathrate hydrates in the ocean. Bouquet et al. (2015) suggests that the clathrate hydrate should be stable in the subsurface region deeper than 22 km. Density of gas hydrates depends on guest gas molecules. For example, methane hydrate is lighter than the water, whereas CO<sub>2</sub> hydrate is heavier. If CO<sub>2</sub> hydrate forms at the bottom of the icy shell, the average density may become large and the ice (water ice + CO<sub>2</sub> hydrate) may try to sink locally. We have developed the observation system of gas hydrate formation and dissociation below the ice sheet. In the presentation, we report the progress of the observation system.

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