# The 439th Geodynamics Seminar

## Experimental investigation of methane hydrates decomposition under high pressure and temperature

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## Abstract

Methane hydrate is thought to be an important constituent of icy planets and their satellites, such as Neptune and Titan. It is a clathrate compound composed of hydrogen-bonded water cages (host) and molecules or atoms (guests) included in the cages. Methane hydrate has an sI structure composed of two 12-hedral and six 14-hedral components in a unit cell at low (< 0.8 GPa) pressures and room temperature. It transforms to an sH cage structure composed of three 12-hedra, two modified 12-hedra, and a 20-hedra at approximately 0.8 GPa, which further transforms to a filled-ice Ih structure at approximately 1.8 GPa. The Ih structure consists of an ice framework similar to ice Ih and voids that are filled with methane molecules. Although the sequence of the phase transitions with pressure have been studied well at room temperature, there are only a few studies that addressed the stability of methane hydrate under high pressure and high temperature. A recent work by Bezacier *et al.* (2014) studied the decomposition temperatures of methane hydrate at pressures between 1.5 and 5 GPa. They demonstrated that it decomposes into solid methane and liquid water at temperatures close to the melting curves of ices, which is, however, not consistent with an earlier report by Kurnosov *et al.* (2006). In addition, the pressure range of these previous studies is only limited to < 5 GPa. Therefore, a further investigation is needed to understand the stability and physicochemical behavior of methane hydrate under extreme conditions corresponding to the interior of icy planets.

In this study, we carefully investigated the stability and decomposition mechanism of methane hydrate in an externally-heated-diamond anvil cell using in-situ Raman spectroscopy in conjunction with optical observation by a high-resolution CCD camera. The results show that methane hydrate decomposes into ice VII and solid methane at temperatures considerably lower than the melting curves of solid methane and Ice VII in the pressure range of 2-51 GPa. The present result should provide basic information for better understanding of the interior of icy planets.


詳細は当センターホームページ：http://www.grc.ehime-u.ac.jp/ をご覧ください
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