

Physical properties and high-pressure forms of gas hydrates

Hisako Hirai[1]

[1] Geoscience, Tsukuba Univ.

Gas hydrates consist of hydrogen-bonded water molecules forming cages and of included guest molecules or atoms in these cages. Methane hydrate lies globally under the oceans on the Earth. Methane hydrate is a promising natural resource, while at the same time methane is a greenhouse gas that plays the most prominent role in global warming. CO₂ hydrate exists also under the oceans, and it has a potential trapping excess CO₂ in the air. And, these gas hydrates are thought to be important components of outer planets and their satellite. Many studies, therefore, have been carried out from wide viewpoints such as phase relations crystal structures, physical properties, and nature of hydrogen bonding. Most of these studies, except for a few, were made at low temperature under ambient pressure. Therefore, high-pressure studies above 1 GPa have to be more intensively pursued to explore new forms in water-methane system, as well as, to survey their possible occurrence on the outer planets. Very recently, several high-pressure experiments have been reported using a diamond anvil cell (DAC) (Hirai et al., 2001; Loveday et al., 2001; Hirai et al., 2002). In this presentation, physical properties of gas hydrates under ambient conditions are summarized, and a wide variety of structural changes under high pressures are reviewed