Geodynamics Seminar

第335回ジオダイナミクスセミナー

Phase changes of filled ice Ih methane hydrate under low temperatures and high pressures

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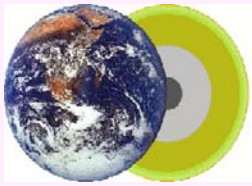
主催：愛媛大学地球深部ダイナミクス研究センター
日時：7/27（金）午後 4時30分～
場所：総合研究棟 4F 会議室



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Abstract

Methane hydrate, called “fiery ice“, is expected an useful natural resource, while methane is an effective green house gas causing global warming. Methane hydrate has been thought to be potentially ubiquitous in space objects such as icy satellites of the solar system and extrasolar planets. Low-pressure phases, sI and sH, are clathrates which comprise host cages formed by hydrogen-bonded water molecules with encapsulated methane molecules. High-pressure phase is a filled ice Ih structure, which is related to the ice Ih structure; methane molecules are filled the channels of an ice Ih-like structure. High-pressure studies on filled ice Ih structure of methane hydrate (referred to as MH-III in this paper) performed at room temperature revealed interesting properties. For example, MH-III survived above 80 GPa with structural changes occurring at about 40 GPa. The structural change was explained to be relating to symmetrization of the host hydrogen bond. And, orientational ordering of guest methane molecules occurred at 15-20 GPa by Raman spectroscopy, although there was no clear change in the X-ray diffraction (XRD) patterns obtained. Recently, distinct changes in lattice vibration modes at 15-20 GPa were reported by a careful Raman study [5]. On the other hand, low-temperature and high-pressure studies on the MH-III have been quite limited. In this study, in order to clarify detail structural change which is accompanied with orientational ordering of guest methane molecules, and to elucidate phase changes at unexplored regions, the low temperatures and high pressures experiments were performed by using clamp-type diamond anvil cells and a helium-refrigeration cryostat in a range from 30 to 300K and 6 to 57 GPa. Isotope effects on the structural changes were also examined using deuterated water. The XRD study and Raman spectroscopy revealed that the axis ratios of MH-III changed clearly at the pressures where the ordering of guest methane molecules occurred at room temperature and low temperatures, that the change in the axis ratios depended on temperature, and that the ordering pressures of the guest molecules were affected by the deuterated water host.

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