Abnormal Thermal Expansion of Clathrate Hydrates Induced by Asymmetric Guest Molecules

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In this study, we investigated the abnormal thermal expansion of clathrate hydrate by the asymmetric guest molecule. We observed the thermal expansion of the tetrahydrofuran(THF) hydrate with 3-types of hydrogen guest molecule(H_2, D_2, HD) and compared the size of cages of them. High-resolution neutron powder diffraction is used to measure the lattice parameter of the structure. Through the structure refinement process, we conclude that THF + HD hydrate can make the bigger cage, because it has asymmetric structure different with others. This peculiar expansion of clathrate hydrates induced by asymmetric structure of guest molecule might be one of the important physics property to understand the properties of the clathrate hydrate.