

Terahertz time-domain spectroscopy on clathrate hydrates: Guest dynamics and thermal behavior of THF + gaseous guest hydrate

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The guest dynamics and thermal behavior occurring in the cages of clathrate hydrates was studied by first-time application of terahertz time-domain (THz-TDS) spectroscopy on tetrahydrofuran (THF) + gas hydrates. The behavior of clathrate hydrates in the THz region has much remained unknown. In this work, THF + gas hydrate pellets were prepared in an LN₂ environment and were applied to the temperature-controlled THz-TDS spectroscopy apparatus. The THz spectra of pure-THF (5.56mol%), THF + CH₄, THF + H₂ and THF + O₂ hydrates were measured in the temperature region of 95 – 260 K. The THF hydrates show distinctive features in the THz range when compared to the hexagonal ice pellet. Furthermore, each trapped gas molecule also showed different absorbance in the THz range. As temperature was raised from 95K during measurement, THF + gas hydrates were degassed and the specific degassing temperatures of each guest molecule were estimated by the abrupt change in the THz spectrum.