Thermodynamic and spectroscopic investigations of aminocyclopentane hydrate for potential application to energy gas storage

이승인, 옥유성[1], 문석윤, 이윤석, 서동주, 박영준†
광주과학기술원; [1]지스트 대학
(young@gist.ac.kr†)

According to the future world energy demand growth, natural gases that mainly consist of CH_4, is in the spotlight due to its lower CO_2 emission. Among the various natural gas storage technologies, gas hydrate, which is a solid inclusion compound formed by host water molecules, has received great attention. Although the gas hydrate-based CH_4 storage technology is considered as a promising option, the thermodynamic pressure–temperature formation conditions must be further alleviated. As a novel approach to achieve the maximal CH_4 storage capacity at the mitigated formation conditions, tuning phenomena on the gas hydrates of various guest promoters have been investigated so far. In this study, aminocyclopentane (ACP) was focused as a tunable liquid promoter for CH_4 storage. The thermodynamic stability of ACP + CH_4 hydrates was examined with the ACP concentrations of 1, 3, and 5.56 mol%. A powder X-ray diffraction and a dispersive Raman spectroscopy were employed to investigate the guest distribution in the distinct hydrate cages. The results revealed that ACP showed thermodynamic promotion effect on the CH_4 hydrate, and confirmed that ACP induced tuning effect on CH_4 hydrate as well.