Phase behavior and characterization of the pure CP and CP + CO_2 hydrates in the presence of NaCl for desalination

이준섭, 이요한, 김소영, 서용원†
UNIST
(ywseo@unist.ac.kr†)

Cyclopentane (CP) itself forms gas hydrate structure under atmospheric pressure in the absence of help gases and can also function as a thermodynamic hydrate promoter, which can move hydrate equilibrium lines to higher temperature and lower pressure. Accordingly, CP hydrate can be utilized for various applications including desalination and gas storage. However, the thermodynamic properties and guest inclusion behaviors of CP and CP + CO_2 systems with NaCl have not been clearly revealed for desalination. In this study, four-phase (H-Lw-LCP-V) equilibria of the CP + CO_2 + NaCl (0, 3.5, and 10 wt %) were measured to determine the thermodynamic stability conditions of gas hydrate systems. The structure and guest distributions of CP hydrates with CO_2 gas were analyzed through Raman spectroscopy. The dissociation enthalpy and hydration number of CP hydrates with various NaCl concentrations were measured using high pressure micro-differential scanning calorimeter (HP μ-DSC). It was found from the experimental results that the CP + guest gas systems form sII hydrates and the phase equilibria were shifted to lower temperature and higher pressure regions depending on NaCl concentrations.