

Thermodynamic and Spectroscopic Studies of Phase Equilibria of HFC-134a (1,1,1,2-Tetrafluoroethane) Hydrate in NaCl Aqueous Solutions

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Gas hydrates can be applied to desalination because they exclude salts or ions from cage lattices during crystallization. However, gas hydrates normally require high-pressure and low-temperature conditions. For gas hydrate-based desalination to be competitive, guest gases which require low pressures for gas hydrate formation should be sought. In this study, HFC-134a, which is widely used as a refrigerant and forms gas hydrates at mild conditions, was used as a guest gas for desalination. Three-phase (hydrate (H)-liquid water(L_w)-vapor (V)) equilibria of the HFC-134a + water mixture in NaCl solutions of 3.5 and 8.0wt% were measured to determine the inhibition effect of NaCl on gas hydrate stability conditions using both a conventional isochoric method and a step-wise differential scanning calorimeter (DSC) method. Heat of dissociation of HFC-134a hydrate was measured to be 147.3kJ/g-hydrate using a high pressure DSC. Furthermore, powder X-Ray diffraction (PXRD) revealed that HFC-134a forms a sII hydrate. The experimental results obtained in this study can be utilized as fundamental data for the hydrate-based desalination process.