

Gas hydrate-based SF₆ separation from SF₆+N₂ gas mixtures: An experimental approach with thermodynamic, kinetic, and structural analyses

고결, 서용원[†]
울산과학기술원
(ywseo@unist.ac.kr[†])

In this study, the feasibility of gas hydrate-based SF₆ separation was studied with respect to thermodynamic, kinetic, and structural aspects. First of all, to verify hydrate stability regions, the three-phase equilibria (hydrate (H)-liquid water (LW)-vapor (V)) of SF₆ + N₂ hydrates were measured. Second, using gas chromatography (GC), the pressure-composition diagram was acquired for estimating SF₆ separation efficiency. Third, the effect of driving force (ΔP) on the rate of hydrate formation was studied by measuring the amount of gas consumed and gas composition changes during hydrate formation. In addition, kinetic selectivity of SF₆ in the hydrate phase was investigated using in-situ Raman spectroscopy and GC. Lastly, as key parameters of process design, the accurate structure and the dissociation enthalpy of SF₆+N₂ hydrates were measured via powder X-ray diffraction (PXRD) and differential scanning calorimeter (DSC). These experimental results would be supportive and fundamental information for the hydrate-based SF₆ separation process.