

SF₆ capture from gas mixtures using hydrate-based gas separation (HBGS)

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This study is about hydrate-based SF₆ (sulfur hexafluoride) separation, which is one of the promising methods for SF₆ separation. The feasibility of hydrate-based SF₆ separation was investigated with a primary focus on structural, thermodynamic, and kinetic aspects. First, the structures of pure SF₆ and SF₆ (50%, 80%, and 90%) + N₂ hydrates were analyzed using powder X-ray diffraction (PXRD) and identified as structure II regardless of the gas compositions. Second, three-phase equilibria (hydrate (H)-liquid water (L_w)-vapor (V)) of SF₆ + N₂ hydrates were measured to determine stable conditions of SF₆ + N₂ hydrates. In addition, the dissociation enthalpy of SF₆+N₂ hydrates was measured via differential scanning calorimeter (DSC). Furthermore, the pressure-composition diagram at 275.15 K was obtained using gas chromatograph (GC) to examine SF₆ separation efficiency. Lastly, the gas composition changes and gas uptakes during hydrate formation were monitored to compare the rate of hydrate formation at different pressure conditions. The overall results of this research are expected to offer key parameters for developing hydrate-based SF₆ separation.