

## Greenhouse gas ( $\text{SF}_6$ ) capture by hydrate-based gas separation

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This study examined the feasibility of hydrate-based  $\text{SF}_6$  separation by measuring thermodynamic, structural, and kinetic characteristics of  $\text{SF}_6 + \text{N}_2$  hydrates. First, the three-phase (hydrate (H) – water ( $L_W$ ) – vapor (V)) equilibria of  $\text{SF}_6 + \text{N}_2$  hydrates were experimentally investigated to demonstrate the effect of  $\text{N}_2$  on the thermodynamic stability of  $\text{SF}_6 + \text{N}_2$  hydrates. Second, a pressure-composition diagram was obtained using gas chromatograph (GC) to assess the  $\text{SF}_6$  separation efficiency. Third, the changes in  $\text{SF}_6$  compositions and the amount of gas consumption during hydrate formation were measured to study the hydrate formation rate and time-dependent selectivity of  $\text{SF}_6$  in the hydrate phase. The kinetic selectivity of  $\text{SF}_6$  was also confirmed using the direct composition measurement and in-situ Raman spectroscopy. Although  $\text{SF}_6$  was preferentially captured in the hydrate phase, significant kinetic selectivity of  $\text{SF}_6$  in the hydrate phase was not observed during the hydrate formation. The experimental results obtained in this study would be useful for designing and operating the hydrate-based  $\text{SF}_6$  separation process.