

Experimental investigation of replacement mechanism occurring in sII (CH₄ + C₃H₈) hydrate through flue gas injection

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Because of the tremendous amount, natural gas hydrates (NGHs) have been regarded as future energy resources. Previous studies to produce natural gas were focused on dissociation-based methods which could induce the geological hazards. The replacement process has been investigated which has triple advantages of CH₄ production, CO₂ sequestration and geological stability. In this study, flue gas (CO₂ (20%) + N₂ (80%)) was injected into the sII (CH₄ + C₃H₈) hydrates to examine its influence on efficiency and structural transition. The efficiency was measured by GC and the hydrate structure was analyzed by ¹³C NMR and PXRD. The results showed that the efficiency using flue gas was lower than that using pure CO₂. NMR spectra and PXRD patterns indicated the iso-structural replacement. The composition of replaced hydrates demonstrated that preferential N₂ occupation greatly contributed to iso-structural replacement. The experimental results are helpful for a better understanding of the replacement mechanism occurring in sII hydrates when flue gas is injected.