

Enhanced Methane Recovery from Methane Hydrates Replaced with Mixed Nitrogen and Carbon Dioxide Flue Gas

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In this research, Raman and ^{13}C NMR spectroscopy are used to investigate the structure and distribution of guest molecules of substituted CH_4 hydrates with $\text{N}_2 + \text{CO}_2$ mixed gas and $\text{CH}_4 + \text{N}_2 + \text{CO}_2$ mixed hydrates. All the structure of the hydrates in this work are revealed to be structure I hydrate from the NMR results. CH_4 , N_2 and CO_2 guest molecules are all identified in the substituted hydrate sample according to the Raman results. Therefore CH_4 in the small and large cages of hydrates are replaced with N_2 and CO_2 gas respectively considering the size of guest molecules. From the ^{13}C NMR results, the peaks which indicate CH_4 in the small and large cavities independently have not a so great deviation. It means that similar amount of N_2 and CO_2 gas occupy the small and large cages of CH_4 hydrates. Consequently, the flue gas consisting of mainly N_2 and CO_2 can be applied to recover CH_4 gas from CH_4 hydrate under the deep sea.