

Facile Storage of Methane in sH Hydrates under Broader Thermodynamic Conditions by Utilizing Pre-constructed sII Hydrate Seeds

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Clathrate hydrates are crystalline inclusion compounds with a remarkable potential for energy storage systems owing to their high gas storage capacity, straightforward synthesis pathway, and environment-friendliness. This work employed pinacolone (PCN) as a thermodynamic promoter with pre-constructed cyclopentane hydrate seeds under static conditions to develop a feasible hydrate-based methane storage system. The use of hydrate seeds and PCN brought the instantaneous nucleation events, leading to the prominent formation of structure H (sH) hydrates containing PCN and methane. The predominant formation of sH hydrates was validated by Raman and PXRD experiments, demonstrating the possibility of facile methane storage in thermodynamically stable sH hydrates. A series of kinetic tests at varying pressure conditions (6.0, 4.5, and 3.5 MPa) were also conducted to assess the impact of PCN under broader operating conditions. By conducting kinetic assessments and spectroscopic measurements, we verified that methane can be readily enclathrated into sH hydrates under all pressure conditions with no induction. This talk presents the comparative assessments of the performance of PCN with that of other structure II hydrate formers for maximizing methane uptakes.