

Thermodynamic and Structural Investigation of sH Hydrate Systems Containing 2,2-dimethylbutane (NH) and methylcyclopentane (MCP)

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Natural gas hydrates (NGHs) are non-stoichiometric compounds that capture gas molecules at high pressure and low temperature conditions, and are regarded as our future clean energy resources. NGHs exist in three different structures; sI, sII, and sH. NGHs with sI and sII have been commonly found in nature. Recently, it was revealed that NGHs with sH also exist in nature and they contain various large molecule guest substances (LMGSs). However, NGH systems containing various LMGSs have not been well studied in the thermodynamic and structural aspect. In this study, the hydrate phase equilibria of the CH₄ + NH + MCP + water systems were measured. The PXRD patterns were analyzed using the FullProf program. The cage occupancy was obtained via ¹³C NMR. The results indicated that both NH and MCP were enclathrated in the large (5¹²6⁸) cages of the single sH structure and thus, the equilibrium curves of the CH₄ + NH + MCP hydrates were located between that of the CH₄ + MCP hydrate and that of the CH₄ + NH hydrate. This study can be expected to contribute to a better understanding of the complex natural gas hydrate systems containing LMGSs.