Thermodynamic Property Measurements on the CH_4-Flue Gas Swapping Process

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As a possible new clean energy source, naturally occurring CH_4 hydrates have promising potential. Research has been recently conducted on the injection of flue gas, which consists mainly of carbon dioxide and nitrogen, from power plants and steelworks into these natural gas reservoirs. Using this method, carbon dioxide is stored stably, mitigating global warming, and a new energy source is exploited. For this method, the thermodynamic properties of CO_2-N_2 hydrates are a critical factor for the CH_4-flue gas swapping process. This study is focused on dissociation enthalpy measurements using DSC (Differential Scanning Calorimeter). Three phase (H-Lw-V) equilibria data are measured as fundamental reference points of the stability conditions of CO_2-N_2 hydrates. CH_4-flue gas hydrates are also microscopically analyzed via NMR (Nuclear Magnetic Resonance), Raman spectroscopy and XRD (X-Ray Diffractometry) in order to determine the effect of swapping on the hydrate structure. These experimentally measured results are fully utilized as fundamental reference data of the CH_4-flue gas swapping process.