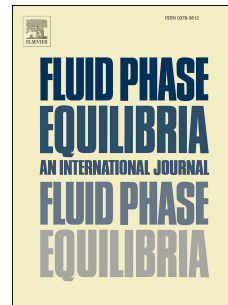


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# An Experimental and Modeling Study on Incipient Hydrate-forming Conditions for Ternary Guests of Carbon Dioxide, Nitrogen and Sulfur Dioxide

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## ABSTRACT

In carbon dioxide capture and sequestration (CCS) processes, captured CO<sub>2</sub> may encounter conditions of hydrate formation due to the presence of water. For stable, long-term operation of CCS processes, hydrate-phase equilibrium data are essential. Captured CO<sub>2</sub> from combustion of fossil fuel may include other impurities such as N<sub>2</sub> and SO<sub>2</sub>. Phase equilibria including a single impurity (N<sub>2</sub> or SO<sub>2</sub>) have been reported by other researchers, but no experimental observations have been obtained for ternary guest systems. In this work, the incipient hydrate-forming temperatures for a binary guest of CO<sub>2</sub> and N<sub>2</sub> and a ternary guest of CO<sub>2</sub>, N<sub>2</sub> and SO<sub>2</sub> were experimentally measured at 2.0-3.5 MPa. An effect of the ratio between guest components and water was observed. The experimental results were compared with calculations using an equation of state based on a hydrogen-bonding nonrandom lattice fluid (NLF-HB) combined with the van der Waals-Platteeuw model. The model predictions were in good agreement with experimental data with an overall average deviation of 2.6%.

Keywords: Hydrates; Sulfur Dioxide; Nitrogen; Carbon Dioxide; Lattice Fluid Equation of State

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