

Thermodynamic and kinetic investigations of mixed cyclopentane-CO₂ hydrates in the presence of salts

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Abstract

The industrial applications of hydrate-based technologies are now growing topics in the hydrate community. Currently, gas hydrate is considered as a novel possibility for desalination, water treatment and carbon capture among other traditional techniques. Using promoters has been promptly proposed for hydrate-based desalination as they could increase hydrate formation rate and reduce the operating pressure.

In this research, we use Cyclopentane (CP) as a hydrate promoter for desalination process *via* CO₂ hydrate crystallization. The objective of this work is to provide the phase equilibrium data of mixed CP-CO₂ hydrates in the presence of new salts (NaBr, KBr, Na₂SO₄, K₂SO₄) and their mixtures under a wide range of concentrations. The experimental data for mixed CP-CO₂ hydrates in the presence of salts are obtained in a batch reactor system with a temperature range of 1÷25°C, a pressure range of 25÷40 bars and salinity of 3.5 wt.%. The effects of salts (NaCl, NaBr, KBr, Na₂SO₄, K₂SO₄) and their mixtures with different concentrations on kinetics of mixed CP-CO₂ hydrates formation are also investigated. Hopefully, this research could formulate or suggest the new fundamental ideas to progress the hydrate-based desalination, water treatment and CO₂ capture.

Keywords: desalination, CO₂ capture, gas hydrates, thermodynamics, kinetics, promoters.