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# Phase Behavior of Methane Hydrate in the Presence of Imidazolium Ionic Liquids and Their Mixtures

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## ABSTRACT

The phase equilibrium conditions of methane hydrate in single ionic liquid aqueous solutions containing low dosage 1-ethyl-3-methylimidazolium nitrate ([Emim][NO<sub>3</sub>]) at mass fractions of 0.01, 0.025, 0.05 are measured in a pressure range of 3.50-15.0 MPa via an isochoric step-heating pressure search method. The thermodynamic inhibition effect of mixed ionic liquids containing [Emim][NO<sub>3</sub>] in conjunction with 1-ethyl-3-methylimidazolium chloride ([Emim][Cl]) at low and high concentrations on methane hydrate formation is also investigated for the possible presence of synergistic effects. It is observed that for all the inhibitor systems containing [Emim][NO<sub>3</sub>] or [Emim][Cl], the inhibition effect increases progressively with the increased concentration and pressure. In addition, the mixture of [Emim][NO<sub>3</sub>] and [Emim][Cl] does not always exhibit synergetic effect on the thermodynamic inhibition of methane hydrate at higher concentrations up to 0.2 mass fraction. The higher concentrations are, the positive interactions between [Emim][NO<sub>3</sub>] and [Emim][Cl] possibly happen at higher pressures.

**KEYWORDS:** phase equilibria, ionic liquid, synergetic effect, methane hydrate, inhibitor

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