

Synergistic Inhibition Effect of Amino Acids and Ionic Liquids on Methane Hydrate Formation

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Gas hydrate inhibitors are often used to prevent plugging risks caused by gas hydrate formation in gas and oilfield operations. In this study, we examined the influence of inhibitor mixtures, which might have different inhibition mechanism, on CH₄ hydrate formation. We used dual function inhibitors (amino acids: glycine and alanine and ionic liquids: [BMIM][BF₄] and [BMIM][I]) and a conventional kinetic hydrate inhibitor (KHI: PVCap). Onset temperature (T_{onset}), heat of dissociation (ΔH_d), and pressure drop (ΔP) were measured to evaluate the synergistic performance of kinetic inhibition for each inhibitor combinations using a high pressure autoclave and a high pressure micro-differential scanning calorimeter (HP μ -DSC). The glycine (0.5 wt.%) + [BMIM][BF₄] (0.5 wt.%) mixture gave the lower onset temperature than PVCap (1.0 wt.%). In addition, the COSMO-RS program was used to evaluate interaction and similarity between inhibitor molecules and water molecules by measuring σ profile. These experimental results will provide a fundamental understanding of synergism for gas hydrate inhibitors and will be useful for natural gas production and transportation.