

Task-Specific Kinetic Inhibitors for Methane Hydrate Inhibition

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Ionic liquids are combined with a polymer kinetic hydrate inhibitor for methane hydrate inhibition. The inhibition effects of the mixtures consisting of poly(N-vinylcaprolactam) (PVCap) and ionic liquids such as N-ethyl-N-methylimidazolium tetrafluoroborate ([EMIM][BF₄]), N-butyl-N-methylpyrrolidinium tetrafluoroborate ([BMP][BF₄]), and N-(2-hydroxyethyl)-N-methylpyrrolidinium tetrafluoroborate ([HEMP][BF₄]) were investigated. The induction times for [EMIM][BF₄] + PVCap, [BMP][BF₄] + PVCap, and [HEMP][BF₄] + PVCap at 0.5 wt% of IL and 0.5 wt% of polymer were 120.3, 65.8, and 184.9 min, respectively. In particular, the inhibitor including [HEMP][BF₄] tremendously extended induction time and reduced hydrate growth rate by forming hydrogen bonding between ionic liquid and water molecules. It was found that all ionic liquids synthesized in this study are powerful synergists for the standard polymer inhibitor.