

## Hydrate-Containing Phase Equilibria for Mixtures of Liquid Carbon Dioxide + Ionic Liquid + Water at High Pressure

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Ionic liquids (ILs) have been found to prevent the gas hydrate formation. When compared with existing inhibitors (MeOH, Ethylene, Glycol etc.), one of the greatest advantages of ionic liquids as inhibitors are diversity. Infinite number of ILs can be synthesized with different combinations of cations and anions. In this study, the ionic liquids chosen consisted of ethyl, butyl, hexyl imidazolium cations in conjunction with six anions ( $\text{BF}_4^-$ ,  $[\text{NTf}_2]^-$ ,  $\text{Cl}^-$ ,  $\text{Br}^-$ ,  $\text{PF}_6^-$  and  $\text{I}^-$ ) and hydroxyethyl-methylpyrrolidinium tetrafluoroborate [HEMP][ $\text{BF}_4$ ]. The dissociation temperatures of  $\text{CO}_2$  hydrate containing ionic liquids were measured using an indirect method at constant high pressure and pre-determined loading composition of all components. The inhibition effects of several ILs were compared by determining  $L_W$ -H- $L_{\text{CO}_2}$  there phase equilibria at constant mass present of ILs in aqueous solution. Ionic liquids shifted the hydrate equilibrium line to a lower temperature by 1 – 2 K depending on the choice of anions and cations. The inhibition effect of various ILs were qualitatively compared using atomistic level molecular calculation.