

Phase equilibria and dissociation enthalpies of HFC-134a hydrate in NaCl solutions for potential application in desalination

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The gas hydrate-based technology has recently attracted significant attention for potential application in desalination. In this study, the three-phase (hydrate (H) - liquid water ( $L_W$ ) - vapor (V)) equilibria of the HFC-134a + NaCl (0, 3.5, and 8.0 wt%) + water systems were measured using both a stepwise differential scanning calorimeter (DSC) method and a conventional isochoric (pVT) method to identify the influence of salts on thermodynamic stability of the HFC-134a hydrate. The stepwise DSC method was found to be less time-consuming and provided reliable hydrate phase equilibria of the HFC-134a hydrates in the NaCl solutions. The significant thermodynamic inhibition was observed in the presence of NaCl. The dissociation enthalpies ( $\Delta H_d$ ) of the HFC-134a hydrates with NaCl were measured using a high pressure micro-differential scanning calorimeter. The presence of NaCl did not demonstrate significant effect on the  $\Delta H_d$  of the HFC-134a hydrate. The experimental results in this study provided fundamental properties for the hydrate-based desalination process using HFC-134a.