Differential Scanning Calorimetry Studies of Gas Hydrate Inhibition

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Gas hydrates continue to pose significant problems in the oil and gas industries, particularly as exploration and production move into deeper water environments. The risks of pipeline blockages due to gas hydrates becomes of greater concern in these deepwater facilities, where much lower temperatures and higher pressures predominate, thus providing the ideal conditions for gas hydrate formation. Low-dosage hydrate inhibitors (LDHIs) may be an attractive technology for preventing pipeline blockages, since they are active at significantly lower concentrations (1.0 vol. %) than traditional thermodynamic inhibitors (30 - 60 vol. %).

In this paper, high pressure Differential Scanning Calorimetry (HP-DSC) has been used to investigate the effect of LDHIs on gas hydrate formation. The effects of LDHIs on hydrate sub-cooling temperatures, nucleation induction times, and hydrate particle agglomerations have been determined, using scanning and isothermal mode DSC methods. The effect of the LDHIs on hydrate growth has also been measured by examining the phase fraction of ice to gas hydrate without and with the addition of inhibitors. Measurements have been performed over the pressure range from 100 to 400 bar, in order to determine whether inhibitor activity depends upon pressure.