Gas Hydrate Plugging Assessment Using High Pressure Differential Scanning Calorimetry

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Gas hydrate formation in subsea oil and gas production flowlines can cause flowline plugging, which creates major economic and safety operational risks. However, it has been reported that surface active agents can reduce the hydrate particle interactions and prevent blockages. These surface active agent can be present naturally in the oil, or injected into the flowlines (i.e. anti-agglomerants, a.k.a. AAs). This then reduces the risk of flowlines plugging due to hydrates. Hence, it is important to be able to conduct a relatively fast and simple screening test as an assessment of the suitability of the hydrocarbon stream for slurry production without hydrate blockage. In this paper, we will introduce a rapid screening method using a high-pressure differential scanning calorimeter (HP-DSC) to evaluate the dispersion strength in lieu of production without hydrate plugging. This method only requires a small oil sample (~15 mg of the water-in-oil (w/o) emulsion). Tests were conducted using w/o emulsions at different water content, salinity, chemical dosage (without and with AAs), and sI/sII hydrate formers. The screening takes about a day and a half. The results of this investigation showed an increase in water content decreased the stability of the emulsion upon hydrate formation and dissociation. This is an indication that the emulsion is unstable with temperature cycling and will ultimately lead to blockage. Over a range of salinities the AAs improved the stability of the emulsion. Structure II (sII) hydrates were found to have higher agglomeration tendency compared to structure I (sI) hydrates. The results obtained from this work shows that the HP-DSC method can be used to efficiently evaluate the hydrate plugging tendency in the flowline and the suitability of a given stream for slurry transport for hydrate control with or without chemicals.