Quantitative Ranking of Hydrate Anti-Agglomerants

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In the flowline, hydrate particles may form and proceed to agglomerate into large aggregates. The agglomeration of hydrate particles introduces a risk of hydrate plug formation in the pipeline. Anti-agglomerants are a subclass of emerging low dosage hydrate inhibitor technologies which are effective at an order of magnitude lower dose rates than conventional thermodynamic inhibitors. Anti-agglomerants prevent hydrate particles aggregating thereby allowing them to be transported as a dispersed slurry. Anti-agglomerants are surfactant molecules that adsorb onto hydrophilic-lipophilic interfaces and reduce the interfacial free energy and hydrate cohesive force. Qualification of anti-agglomerants and development of new anti-agglomerants is important for the oil and gas industry to enable deployment in environmentally sensitive locations and under extreme operating conditions. Current methods of qualifying anti-agglomerants use high pressure rocking cells to assess whether a hydrate forming mixture will lead to a solid plug. In this work, we present and compare new methods of qualifying anti-agglomerants using quantitative measures of anti-agglomerant performance against traditional methods for seven industry antiagglomerants. Using a novel micromechanical force apparatus and an oil-water interfacial tensiometer, we have observed that for current industry AAs, the strong reduction in hydrate cohesive force is linked with reductions at the oil-water interface. Additionally, we have measured crystal growth rates using the micromechanical force apparatus and have observed that industry AAs slow the growth of hydrate. The ranking of AA performance determined with the MMF apparatus is compared with that obtained using a high pressure visual sapphire autoclave.