

Competitive Effects of Chemicals on Hydrate Particle Cohesion

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In oilfield production conditions, many chemicals are present, both in the form of natural surfactants that are present in the oil phase, as well as additives that are injected to control the properties of the oil phase. These additives may include Low Dosage Hydrate Inhibitors (LDHIs) such as Kinetic Hydrate Inhibitors (KHIs) or Anti-Agglomerants (AAs), corrosion or scale inhibitors, dispersants, etc. In order to achieve slurry flow in subsea oil pipelines, the agglomeration of hydrate particles needs to be minimized so that the small, dispersed hydrates are transportable rather than forming larger aggregations that may plug the pipeline. This study focuses on the interactions of several classes of chemicals on the cohesion force between two hydrate particles. A Micromechanical Force apparatus was used to measure the changes in the cohesion force for cyclopentane hydrates when a dispersant, a KHI, and a model AA are added to the cyclopentane phase. The cohesion force is tested for individual chemicals, as well as when multiple chemicals are present. It was found that the interaction of specific chemicals can work synergistically, where the effect is greater than either additive can produce on its own, or antagonistically where the effect is reduced for the chemical mixture, or show no interaction where the cohesion force is similar to when only the more effective chemical is present.