Hydrate Agglomeration in Oil-Dominated Systems at Different Driving Forces

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Gas hydrates (GHs) are inclusion compounds in which small gas molecules (e.g., methane and CO_2) are trapped in a hydrogen-bonded water structure. GHs form typically at high pressures and low temperatures, which are conditions commonly encountered in offshore oil & gas production operations. Hydrate formation in transmission lines represents a serious problem for industry that could reduce or even arrest hydrocarbon production. This issue can be avoided by adding some polar substances, collectively known as thermodynamic hydrate inhibitors (THI), that shift the hydrate equilibrium region towards harsher conditions (higher pressures and lower temperatures). Management is a different strategy to mitigate hydrate issues in which some chemicals are added at low concentrations to delay hydrate formation (kinetic hydrate inhibition) or to reduce/avoid hydrate agglomeration (anti-agglomeration). Recently, a lot of attention has been paid to the behavior of some crude oils that naturally avoid hydrate agglomeration and plugging. It has been demonstrated that some oil fractions (e.g., acids and asphaltenes) are key in that hydrate non-plugging behavior. This work uses a rocking cell apparatus to show the gas hydrate agglomeration tendency of several crude oils, and how this intrinsic property changes with the hydrate formation driving force. Changes in the operation pressure allow us to manipulate the hydrate driving force. Since the hydrate non-plugging potential may be linked to the oils' interfacial behavior, additional assessments such as emulsion stability and water-oil interfacial tension are performed and correlated with the hydrate agglomeration experiments.