Microscale Evaluation of Hydrate Interparticle Interactions

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Understanding the surface and interfacial properties of hydrates is key to formulating predictions regarding their formation and interparticle interactions. The prerequisites for hydrate formation are intricately linked to a combination of thermodynamic, kinetic, and physicochemical conditions. Moreover, the interfacial environment plays a crucial role in dictating the nature of the interactions once formed. Changing the chemical environment around hydrates can incur a new plethora of interactions. So, there is a need to understand the impact of perturbing the chemistry around and in the hydrate interface. In this study, a set of commercial and natural chemicals that interact with the hydrate, water, and oil phases were investigated to differentiate their effects on hydrate formation and agglomeration. A model oil was used to establish a baseline and to describe the effects of chemical interactions caused by the surface and the interfacial species. Initial results indicate that more pronounced effects are seen when chemical species are present at the water/hydrate interface. This is consistent with previous studies conducted on hydrates with commercial surfactants, and experiments with asphaltenes (natural surfactants) on hydrates. The alterations to hydrate morphology, changes in wettability, and variations of capillary forces are used to describe interparticle interactions and understand hydrate agglomeration.