Effects of Hydrophobic Particles for Hydrate Formation

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To understand the hydrate formation behaviors, we introduced hydrophobic silica nanoparticles (SiNPs) in the flat interface of oil and water as well as the water-in-oil emulsions. First, we identified the mechanism of hydrate inhibition by SiNPs in the flat interface of oil and water by using micro-differential scanning calorimetry (micro-DSC) and optical microscope. As the concentration of SiNPs increases, the SiNP-laden interface completely prevented hydrate growth; and thus; the hydrate formation can be inhibited by SiNPs in the flat interface. Second, we also adressed the effects of SiNPs on methane hydrate formation in water-in-decane emulsions. We performed numerous experiments for hydrate formation with variying the concentration of SiNPs applied to water-in-decane emulsions, and thus; we tried to verify how the nanoparticles interact at the interface for hydrate inhibition or promotion. Inhibition of hydrate formation was observed at lower concentrations of SiNPs. However, as the amount of SiNPs increases, the formation rate dramatically increases. Finally, we proposed the mechanism of hydrate formation in the presence of SiNPs in water-in-oil emulsions.