

Hydrophobic Particle Effects on Hydrate Crystal Growth at the Water – Oil Interface

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This study introduced hydrophobic silica nanoparticles into an interface of aqueous and hydrate-forming oil phases and analyzed the inhibition of hydrate crystal growth after seeding hydrate slurries. The hydrate inhibition performance was quantitatively identified by micro-differential scanning calorimeter (micro-DSC) experiments. Through the addition of 1.0 wt% of silica nanoparticles into the water – oil interface, the hydrate crystal growth only occurs around the seeding position of cyclopentane (CP) hydrate slurry and the growth of hydrate crystals is retarded. For further increase in the silica nanoparticle concentration up to 2.0 wt%, the silica nanoparticles-laden interface completely prevents hydrate growth. We observed a hollow conical shape of hydrate crystals both in the absence of the silica nanoparticles. But the size and shape of the conical crystals are shrunken at 1.0 wt% of silica nanoparticles. However, the conical shape does not appear with the increased nanoparticle concentration of 2 wt%. These findings can provide insights into hydrate inhibition in oil and gas delivery lines possibly with nano particles.