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Studies on Model Water-in-Oil (w/o) Emulsions: Phase Behavior, Emulsion Stability, and Hydrate Formation

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ABSTRACT

Colloidal dispersions are widely encountered in several industrial settings including in ink, paint, and food formulations, as well as during subsea oil production. The present study focusses on the formation of hydrates in subsea oil pipelines from colloidal precursors that cause plugging and have tremendous environmental and economic consequences. Model systems for hydrate precursors are studied – water in cyclopentane emulsions stabilized by either SPAN 80 or AOT surfactants. The phase behavior, emulsion stability, and hydrate formation mechanisms are delineated using experimental techniques such as dynamic light scattering, spectroturbidimetry, and differential scanning calorimetry. The phase behavior is found to strongly depend upon the emulsion stabilizer with AOT systems displaying strong "solubilization" in contrast to SPAN 80 systems. Furthermore, for AOT systems the emulsion stability decreases with an increase in AOT concentration from 1 wt% to 5 wt %. For SPAN 80 systems, the emulsion stability is largely unaffected by its concentration. Additionally studies are underway to study the effect of temperature on emulsion stability and to identify the mechanisms for hydrate growth. Overall, the insights obtained from the present study will help in designing strategies for hydrate plug prevention, thereby, facilitating safe and economic oil production.

KEYWORDS

Colloidal dispersion, emulsion stability, hydrate formation, surfactant, phase behavior

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