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Insights into the formation mechanism of hydrate plugging in pipelines

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Abstract: Experiments from three-phase (natural gas + water + diesel oil) flow systems were performed in a flowloop to study the hydrate formation and plugging mechanisms from data on morphology and flow characteristics. The hydrate plugging mechanism was investigated for a range of water cuts (5 to 80 vol%) and the injection of chemical additives (glycol and Inhibex 501). The results from the flowloop experiments demonstrated that water and oil formed a disperse system in which water formed a three-dimensional network, separating oil into a mass of oil droplets before hydrate formation; when hydrate began to form, the water network converted into a hydrate network and formed a very sticky oil-in-hydrate network system; With the hydrate formation, some of the oil was squeezed out of the network and the oil-in-hydrate network system shrank, precipitated from the oil phase, and deposited onto the pipe wall, and finally formed hydrate plugging. The presence of glycol or Inhibex 501 did not change the formation mechanism of hydrate plugging, while it decreased the hydrate formation rate.

Keywords: hydrate; flow characteristics; plugging; inhibitor; morphology

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