

## **DIFFERENTIAL GAS CONSUMPTION DURING GAS HYDRATE FORMATION IN THREE-COMPONENT GAS MIXTURE – DRIVING FORCE IMPLICATIONS**

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In the petroleum industry, gas hydrate formation in oil/gas-brine media is a major concern. (Mokhatab et al., 2007). In this work, the kinetics of hydrate formation in methane, ethane, propane, water system was studied both with and without an oil phase present.

In the pure system the changes in the mole fractions of each gas component vs. time throughout the reactions are traced by means of gas chromatography, thus the kinetics of consumption for each individual gas component can be derived. Subsequently, simulations of cavity occupancies for each component are made and the results are compared with theoretical calculations.

In water-gas-oil systems, hydrates are formed by cooling the system from a temperature outside the hydrate area to a value within the range of stable hydrate formation. Different cooling rates are used, and the observed pressure-temperature behaviour is investigated in order to estimate the region of the meta-stability.

Curves describing the kinetics of the hydrate formation are derived from the pressure drop in the system and the results indicate that in a finite-volume-multi-component system, every component is consumed at a different rate, as shown in Figure 1. The continuously changing composition results changes in the driving force during hydrate formation. The rate of the changes must be evaluated in order to develop models that can correctly describe and predict the hydrate formation processes. These factors are also expected to play a role for the mechanisms of nucleation and growth of hydrate plugs in pipelines.

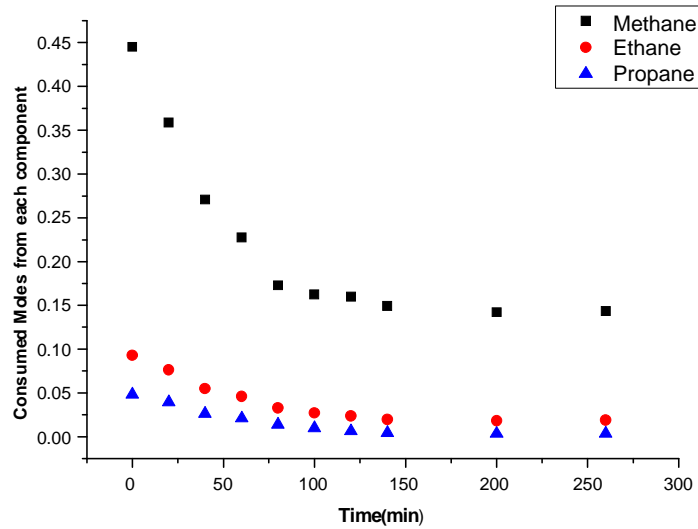


Figure 1. Consumption of each gas phase component over time during hydrate formation in a gas-water system.

#### REFERENCE

Mokhatab, S., Wilkens, R. J., Leontaritis KJ (Leontaritis, K. J.), A review of strategies for solving gas-hydrate problems in subsea pipelines, recovery utilization and environmental effects. *Energy Sources part A*. 29 (1): 39-45 JAN 1 2007.