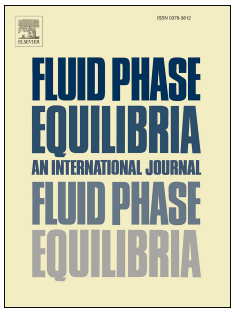

Thermodynamic modeling of gas hydrate formation in presence of thermodynamic inhibitors with a new association equation of state

Amir Hossein Saeedi Dehaghani, Mohammad Hasan Badizad

PII: S0378-3812(16)30351-X

DOI: 10.1016/j.fluid.2016.07.021

Reference: FLUID 11193

To appear in: *Fluid Phase Equilibria*

Received Date: 25 April 2016

Revised Date: 14 July 2016

Accepted Date: 21 July 2016

Please cite this article as: A.H.S. Dehaghani, M.H. Badizad, Thermodynamic modeling of gas hydrate formation in presence of thermodynamic inhibitors with a new association equation of state, *Fluid Phase Equilibria* (2016), doi: 10.1016/j.fluid.2016.07.021.

Thermodynamic Modeling of Gas Hydrate Formation in Presence of Thermodynamic Inhibitors with a New Association Equation of State

Amir Hossein Saeedi Dehaghani*, Mohammad Hasan Badizad
Petroleum Engineering Group, Faculty of Chemical Engineering, Tarbiat Modares University, Tehran, Iran
*(*Corresponding Author's email: asaeedi@modares.ac.ir)*

Abstract

Formation of hydrate crystal particles has been one of the major difficulties facing gas industry in the generation, transmission, and processing that causes blockage of pipelines and equipment resulting in decreases of level of safety and immunity Which necessitating proper methods to prevent hydrate formation. One of the most common treatments are injection of chemical inhibitors. Keeping excessive cost of hydrate remediation and inhibition in mind, using a reliable predictive model is the key step of designing a natural gas transmission operation.

In this paper the vander Waals and Platteeuw (vdW-P) model was coupled with Dehaghani et al.'s association equation of state (DA-EOS) for prediction of equilibrium temperature of methane hydrate in presence of methanol (MeOH), ethanol (EtOH), and mono-ethylene glycol (MEG) as thermodynamic inhibitors. To increase the calculation accuracy, the mole fraction of components in the liquid and gas phases were obtained using the results of flash algorithm calculations. In addition, effect of gas dissolution in aqueous phase was considered by Henry's law and water activity coefficient calculation was performed based on φ- φ approach. Additionally, the binary components interaction coefficients in the system, was considered as a linear function of temperature.

To evaluate the capability of DA-EOS, the prediction of methane hydrate phase behavior in presence and absence of inhibitors was compared with the experimental data and also the prediction of Peng-Robinson EOS (PR-EOS). In addition, a comparison was made between DA-EOS and Elliott–Suresh–Donohue Equation of State (ESD-EOS) to gain insight of performance of present model. The prediction of DA-EOS and ESD-EOS was close to each other. DA-EOS proved to be effective in representing self-association between water and cross-association between water-inhibitor components in the case of hydrate solution. Also, it was concluded that performance of vdW-P model strongly depends on reliability of EOS used for calculation of fugacity coefficient.

Key words: Methane hydrate; thermodynamic inhibitor; vdW-P model; Association Equation of State