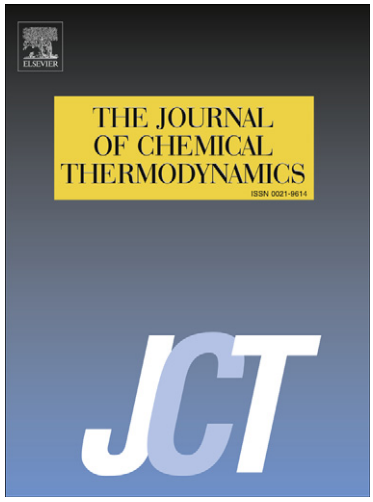

Hydrate phase equilibrium of ternary gas mixtures containing carbon dioxide, hydrogen and propane

Ponnivalavan Babu, Ting Yang, Hari Prakash Veluswamy, Rajnish Kumar, Praveen Linga

PII: S0021-9614(13)00066-9
DOI: http://dx.doi.org/10.1016/j.jct.2013.02.003
Reference: YJCHT 3449

To appear in: *J. Chem. Thermodynamics*

Received Date: 7 October 2012
Revised Date: 28 January 2013
Accepted Date: 2 February 2013

Please cite this article as: P. Babu, T. Yang, H.P. Veluswamy, R. Kumar, P. Linga, Hydrate phase equilibrium of ternary gas mixtures containing carbon dioxide, hydrogen and propane, *J. Chem. Thermodynamics* (2013), doi: http://dx.doi.org/10.1016/j.jct.2013.02.003

Hydrate phase equilibrium of ternary gas mixtures containing carbon dioxide, hydrogen and propane

*Ponnivalavan Babu[1], Ting Yang[1], Hari Prakash Veluswamy[1], Rajnish Kumar[2], Praveen Linga[1]**

[1]Department of Chemical and Biomolecular Engineering, National University of Singapore, Singapore, Singapore 117 576

[2]Chemical Engineering and Process Development Division, CSIR- National Chemical Laboratory, Pune, India

Abstract:

Hydrate phase equilibrium of the ternary guest mixtures containing carbon dioxide, hydrogen and propane at two different compositions were determined. Addition of mole composition of 2.5 % propane to the fuel gas (CO_2 (40 %)/H_2 (60 %)) mixture reduces the hydrate formation conditions by 66 % at the temperature of 278.4 K. A Clausius-Clapeyron plot for the experimental results was plotted and from the slope, the enthalpy of hydrate dissociation was calculated. The enthalpy of dissociation of the mixed hydrate formed from a ternary gas mixture containing mole composition 38.1 % CO_2, 59.4 % H_2 and 2.5 % C_3H_8 was found to be 110 kJ·mol^{-1} and hence it was concluded that the mixed hydrate formed structure II (sII) hydrates. Whereas for the ternary gas mixture containing mole composition 80.0 % CO_2, 18.8 % H_2, and 1.2 % C_3H_8, the enthalpy of dissociation of the mixed hydrate was found to be 78 kJ·mol^{-1} and hence we believe the mixed hydrate formed the structure I (sI) hydrate.

Keywords:gas hydrates; thermodynamics; pre-combustion; carbon dioxide capture; global warming, phase equilibrium

*corresponding author, Tel: (65) 6601-1487; e-mail: chepl@nus.edu.sg; Fax: (65) 6779-1936.