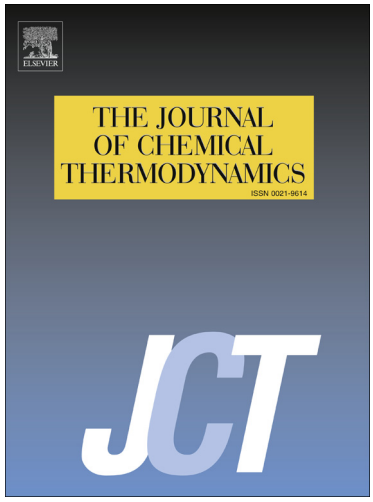

Kinetic and Thermodynamic Behavior of CF_4 Clathrate Hydrates

Saeedeh Babaee, Hamed Hashemi, Amir H. Mohammadi, Paramespri Naidoo, Deresh Ramjugernath

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Kinetic and Thermodynamic Behavior of CF_4 Clathrate Hydrates

Saeedeh Babaee [a,b], Hamed Hashemi [a,b], Amir H. Mohammadi [a,c,*], Paramespri Naidoo [a], Deresh Ramjugernath [a,†]

[a] Thermodynamics Research Unit, School of Engineering, University of KwaZulu-Natal, Howard College Campus, King George V Avenue, Durban 4041, South Africa.

[b] Department of Chemical Engineering, Buinzahra Branch, Islamic Azad University, Buinzahra, Iran

[c] Institut de Recherche en Génie Chimique et Pétrolier (IRGCP), Paris Cedex, France.

Abstract - This study presents experimental kinetic and thermodynamic data for CF_4 clathrate hydrates. Experimental measurements were undertaken in a high pressure equilibrium cell with a 40 cm^3 inner volume. The measurements of experimental hydrate dissociation conditions were performed in the temperature range of (273.8 to 278.3) K and pressures ranging from (4.55 to 11.57) MPa. A thermodynamic model based on van der Waals and Platteeuw (vdW-P) solid solution theory was used for prediction and comparison of hydrate dissociation conditions and the Langmuir constant parameters for CF_4 based on Parrish and Prausnitz equation are reported. For the kinetics, the effect of initial pressure and temperature on the induction time, CF_4 hydrate formation rate, the apparent rate constant of reaction, storage capacity, and water to hydrate conversion during the hydrate formation were studied. Kinetic experiments were performed at initial temperatures of (275.3, 276.1 and 276.6) K and initial pressures of (7.08, 7.92, 9.11, 11.47 and 11.83) MPa. Results show that increasing the initial pressure at constant temperature decreases the induction time, while CF_4 hydrate formation rate, the apparent rate constant of reaction, storage capacity, and water to hydrate conversion increase. The same trends are observed with a decrease in the initial temperature at constant pressure.

*E-mail: a.h.m@irgcp.fr & amir_h_mohammadi@yahoo.com

#E-mail:ramjuger@ukzn.ac.za