Experimental Measurements of Dissociation Conditions for Water + CO_2 + Decane Mixture in the Hydrate Formation

Pedro Esquival-Mora, Luis E. Juárez-Vergara, Luis A. Galicia-Luna [C,S], Jose J. Castro-Arellano and Alfredo Pimentel-Rodas

Laboratorio de Termodinamica, Instituto Politecnico Nacional, México DF, México

lgalicial@ipn.mx

Gas hydrates are crystalline ice-like inclusion compounds in which the guest molecules are trapped in lattices composed of cages formed by hydrogen-bonded host molecules under certain temperature and pressure conditions. In the past, gas hydrate formation has been regarded as a serious impediment to oil and gas production because the hydrate formation during production induces pipeline plugging; hence, extensive research has been conducted to avoid this problem. However, the utilization of gas hydrates has recently attracted great attention in various fields: natural gas transportation/storage, carbon dioxide (CO_2) capture and desalination. Hence, hydrate-based gas separation could be an alternative approach for CO_2 capture and further research and developments need to be performed for the industrial implementation. In this work, new equilibrium data (pressure, temperature and composition) for carbon dioxide (CO_2) + water (H_2O) + decane ($C_{10}H_{22}$) mixture have been experimentally measured to determine the stability regions and dissociation conditions of the formed hydrates. The hydrates have been formed in aqueous solutions with mass fractions ($C_{10}H_{22}$) of 0.05 and 0.10. The hydrates dissociation conditions have been measured using a modified apparatus designed and built to operate at pressures up to 35 MPa and temperature between (253 and 303) K based in the isochoric method. The expanded combined uncertainties of the dissociation conditions were evaluated to be 0.004 MPa, 0.015 K and 0.00025 %mol in pressure, temperature and composition, respectively. On the other hand, in the international literature there are no experimental data on the equilibrium mixture under study, reinforcing the importance of expanding the thermophysical experimental data of liquid hydrocarbon mixtures for a better understanding of the hydrate behavior.