

An experimental study of gas hydrate formation of CH₄-C₃H₈ binary mixture under the non-equilibrium conditions

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Résumé

Gas hydrates are a crucial issue in many fields, from oil & gas industry, to carbon capture and storage, air conditioning, or even planetary science. They also have an enormous potential as an energy resource because of the tremendous quantity of methane trapped within them. To understand better the gas hydrates phenomena, understanding of the thermodynamics and the crystallization mechanisms of clathrate hydrates are required. The determination of the hydrate composition and volume is also a technical challenge and we recall in the paper the method used by our laboratory. In this work, several experiments were performed to obtain precious experimental data and the gas compositions in hydrate phase. GasHyDyn group has recently found out that the composition of gas hydrate is sensitive to the crystallization conditions. Hence in this work, it was tried to understand better the relation between the composition of hydrate during the crystallization and final state and crystallization rates. Experiments were performed in a batch reactor and there were an online gas chromatography connected to the experimental set-up and an off-line ion-chromatography to measure the gas compositions and liquid compositions, respectively. Based on these data and mass balance, the gas compositions in hydrate phase and hydrate volume can be calculated. During the last decade, our GasHyDyn team has also measured equilibrium data for many gas mixtures, and this document adds new data involving propane. In the present work, the experimental results are discussed after formation following two different experimental protocols: at quick and slow rates of crystallizations. It was observed that, from the same initial conditions, the final pressure and water conversion for two different procedures are slightly different (Figure 1).

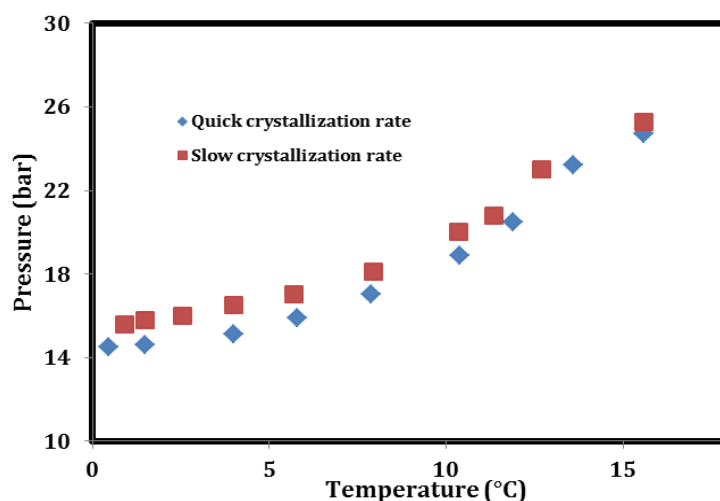


Figure 1. PT diagram for two different experimental procedures with the same initial conditions: quick and slow crystallization rates

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