***In situ* monitoring of the formation of mixed CO2/CH4 gas hydrates via Raman spectroscopy**

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**Highlights**

* *In situ* analysis of gas hydrate formation.
* Gas separation

**1. Introduction**

Gas hydrates are crystalline ice-like solids that consist of a three dimensional network of hydrogen bonded water molecules stabilized by the incorporation of small guest molecules, such as carbon dioxide (CO2) or methane (CH4).

Hydrate formation is a promising technology for gas separation processes, due to the gas specific thermodynamics of incorporation. For example, at certain pressure and temperature, the incorporation of CO2 molecules is preferred compared to CH4 molecules, which can be utilized for the separation of shale gas, biogas or the capture of CO2 from flue gas. In order to improve the separation process, fundamental understanding of the formation kinetics of the mixed gas hydrates on a molecular level is crucial.

**2. Setup and Measurements**

Here we present an experimental study on the formation kinetics of the formation of mixed CO2/CH4 gas hydrates. The experimental setup allows for the in situ monitoring of the composition of the gas phase as well as the hydrate phase during hydrate formation. The influence of initial gas composition, temperature and pressure on the evolution of the composition in the gas and in the hydrate phase is analyzed.

**3. Conclusions**

With our study, we aim to contribute further inside into the formation kinetics of mixed gas hydrates.

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