



# PROPERTIES AND APPLICATION OF ADDITIVE ENHANCED CO<sub>2</sub> HYDRATES

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## PROBLEM

CO<sub>2</sub> hydrates can be formed at moderate temperature and pressure conditions (such as 5 °C, 15 bar); but this is a time-consuming procedure. At room temperature and ambient pressure CO<sub>2</sub> hydrates decompose again.

## OBJECTIVE

Fundamental insights in structure-property-relationships will enable the efficient use of promoting additives in different fields of applications (CO<sub>2</sub> sequestration, cooling) and will also create new products.

## ABSTRACT

The ability to control the process of CO<sub>2</sub> hydrate formation or dissociation by various additives is crucial (figure 1). Such additives may affect both kinetics and thermodynamics of hydrate formation and dissociation. One of the objectives of this study is to establish appropriate methods to characterize processes, so that additive effects on structure and properties of CO<sub>2</sub> hydrates could be investigated.

The experimental set-up of the glass pressure reactor system to visually observe hydrate formation is shown in figure 2. Pressure-temperature curves over time of the first conducted experiments with the reactor system are illustrated in figure 3. Hydrate nucleation (as point of turbidity) and growth can be observed with the glass reactor system.

The emphasis of past additive developments concentrated particularly on the supply of inhibitors which restrain the formation of undesired hydrate structures. Promoters (nucleating agents, agglomerates) can efficiently control kinetics and thermodynamics of the hydrate formation and – dissociation. The targeted use of additives can significantly minimize the time and energy demand of hydrate-based technologies.

## RESULTS

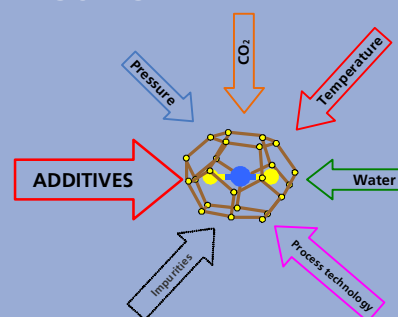


Figure 1: Influences on hydrate formation

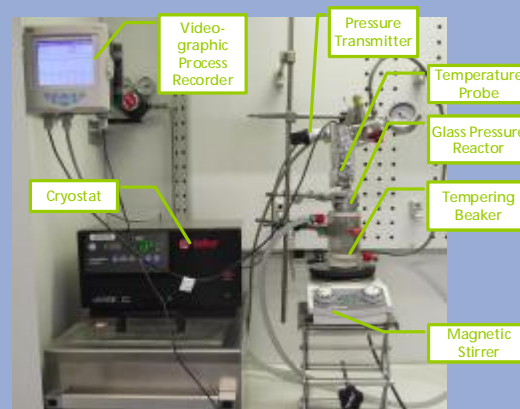


Figure 2: Experimental set-up of reactor system

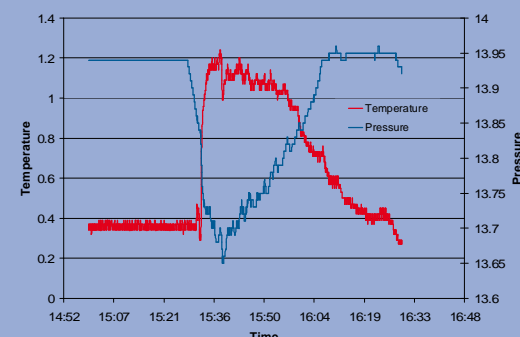


Figure 3: Pressure-Temperature curves during CO<sub>2</sub> hydrate formation