

## CO<sub>2</sub> Capture from CO<sub>2</sub> + H<sub>2</sub> Gas Mixture Using Tetra-*n*-butyl Ammonium Chloride Semiclathrate

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In this study, tetra-*n*-butyl ammonium chloride (TBAC) was used for semiclathrate formation. TBAC forms semiclathrate with water under atmospheric pressure. TBAC semiclathrate has small vacant cages which can be used for capturing small-sized gas molecules, while large cages of TBAC semiclathrate are occupied by TBA cations. TBAC semiclathrate is most stable at 3.3 mol%, which is a stoichiometric concentration. This study is focused on the selective CO<sub>2</sub> separation from the pre-combustion fuel gas mixture using TBAC semiclathrate. The phase equilibria showed that the TBAC semiclathrate with CO<sub>2</sub> + H<sub>2</sub> was significantly stabilized when compared with pure gas hydrate. The enclathration of guest molecules in the small cages was confirmed via in-situ Raman spectroscopy. The gas uptake of TBAC semiclathrate in the presence of hollow silica and solid silica was higher than that of TBAC semiclathrate without silica particles. The CO<sub>2</sub> concentration in the semiclathrate phase was found to be approximately 90 %. Through the experimental results obtained in this study, TBAC semiclathrate is expected to be a good candidate material for CO<sub>2</sub> separation from pre-combustion fuel gas mixtures.