Research on the Microscopic Mechanism of CO_2 Capture Using TBAB Semi-Clathrate Hydrate Formation

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Purpose of my research (1) Use a new additive to form semi-clathrate hydrate at lower pressures and higher temperatures for CO_2 capture. (Research question) (2) Can Tetra-n-butyl Ammonium Bromide (TBAB) work? (3) Understand the mechanism of CO_2 capture by TBAB semi-clathrate from different aspects (microscopic morphology, Raman spectroscopy, etc.) (4) Find out if TBAB semi-clathrate can capture CO_2 efficiently Experimental procedure High-pressure DSC Measure the temperature and pressure data for CO_2 hydrate formation. Find out the thermodynamic conditions for TBAB + CO_2semi-clathrate hydrate formation. Microscopic experiment Explore the morphology of TBAB + CO_2 semiclathrate by recording the microscopic images. Obtain the microscopic images of TBAB+CO_2semi-clathrate hydrate. Understand the hydrate growth behavior. Raman experiment Measure Raman spectral intensity and determine the structure transition of TBAB + CO_2 semi-clathrate hydrate. Disclose the mechanism of CO_2 capture on the molecular scale. Conclusions It is found that TBAB is an effective additive which can form semi-clathrate hydrate for CO_2 capture at lower pressures and higher temperatures. The microscopic observation and Raman spectroscopy experiments indicate that 2.57 mol% TBAB is the optimal concentration for CO_2 capture. The fastest rate of TBAB+CO_2 hydrate is obtained at 2.57 mol% TBAB, and the largest amount of CO_2 is captured at this TBAB concentration

Awards Won:

YM American Academy: Third Award of $500.00