

Effects of Thermodynamic Promotors on Clathrate-based CO<sub>2</sub> Capture from Flue Gas

김소영, 서용원†

울산과학기술대학교

(ywseo@unist.ac.kr†)

In this study, tetrahydrofuran (THF) as a water miscible sII hydrate former, tetra-butyl ammonium chloride (TBAC) as a water soluble semiclathrate former, and cyclopentane (CP) as a water immiscible sII hydrate former were used for comparing their thermodynamic and kinetic performance during hydrate or semiclathrate formation and investigating gas separation efficiency. Phase equilibria of CO<sub>2</sub> (20%) + N<sub>2</sub> (80%) + THF (5.6mol%), TBAC (3.3mol%), and CP (5.6mol%) mixtures were measured to determine stability conditions. These thermodynamic promotors can significantly reduce the equilibrium pressure by filling large cages or partially broken large cages. Gas uptake and CO<sub>2</sub> composition changes in the vapor phases were analyzed using gas chromatography. The enclathration of CO<sub>2</sub> in small cages was confirmed via Raman spectroscopy. Amount of gas uptake was in the following order: TBAC < CP < THF. However, the CO<sub>2</sub> concentration in hydrate phase after completion of hydrate or semiclathrate formation was found to be approximately 35% for THF and CP hydrate, while 60% for TBAC semiclathrates. From the overall experimental results, TBAC as the semiclathrate former is expected to be a good candidate for clathrate-based CO<sub>2</sub> separation process from flue gas.