Effect of micro-sized geometrical constraint on swapping phenomena between CH_4 molecules and CO_2+N_2 mixed gas molecules in hydrate cages

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In this study, we investigated the effect of geometrical constraints on swapping phenomenon. Our group members reported that CH_4 molecules in the hydrate cages could be replaced by CO_2 + N_2 mixed gas molecules without damaging structure of hydrate. To commercialize this technique, we need to collect data about kinetic phenomena of swapping reaction. Especially we focused on effect of pore size on kinetic behavior during swapping process.

Silica gel, mesoporous material containing pores with diameters between 2 and 50 nm, was used as hydrate bearing sediments. Firstly, pore of silica gel was saturated by vaporizing water in vacuum condition more than 7 days. Saturated silica gel was pressurized at moderate temperature and pressure condition by injecting CH_4 gas in high pressure cell. Exchange rate between CH_4 and CO_2 + N_2 molecules was measured by in situ Gas Chromatography during swapping process.

Lots of studies have been preceded by oceanic, mechanic, geologic, and chemical engineers to develop methods for exploring and producing natural gas from deep sea reservoir. The present investigation may contribute to understanding the swapping phenomena and commercialize this method.