Tuning behavior of clathrate hydrates for hydrogen-natural gas blends storage

안윤호†
숭실대학교
(yhahn@ssu.ac.kr†)

Harvesting energy gases in the nanoporous water-frameworks of clathrate hydrate enables widespread hydrogen-based fuels converted from renewable energy sources (i.e., Power-to-Gas). However, there has always been a critical trade-off between mild formation conditions and maximum working capacity. The 'natural gas modulator' leads to significantly reduced synthesis pressure with the formation of hydrogen clusters in the confined nanoporous cages of clathrate hydrates. Instead of employing hazardous liquid thermodynamic promoter, clean energy gas of natural gas allows multiple hydrogen occupations in all cages (5^{12}, $5^{12}6^2$, and $5^{12}6^4$ cages) of hydrogen-natural gas hydrates without any post-synthetic modification. The critical hydrogen concentration (CHC) of hydrogen-natural gas blends that enables the maximum hydrogen storage capacity of the hydrate and the corresponding formation rate need to be explored for the efficient storage of hydrogen-natural gas blends. These findings provide practical insights for developing clathrate hydrate-based hydrogen-natural gas blends storage media and transportation systems in the near future.