Sustainability of Hollow Silica Matrix for Gas Hydrate Recycling

Storage and transportation of greenhouse gases such as methane (CH_4) and carbon dioxide (CO_2) are of current interest. Converting these gases into hydrates a priori is a workable option because 180 STP units of gas can be compressed into unit volume of hydrate. Drawbacks, however, are sluggish and inefficient hydrate conversions which can be defeated with the help of suitable porous materials. This study reports the sustainability of low density silica (SiO_2), as matrix material, for a number of freezing – thawing cycles without significant loss in hydrate fractions. Methane hydrate experiments were conducted at high pressure (72 atm) and near ice melting temperatures. More than 70 % water got converted into hydrates within a short span of 2 hours. Thus, the hydrates formed in SiO_2 matrix possess attractive features such as rapid and high convertibility to hydrate and also high recyclability; essential for gas storage and transportation applications.

For further details: Kandadai Sowjanya and Pinnelli S.R. Prasad, *J Nat Gas Sci Eng., 2016*.

doi:10.1016/j.jngse.2016.07.027

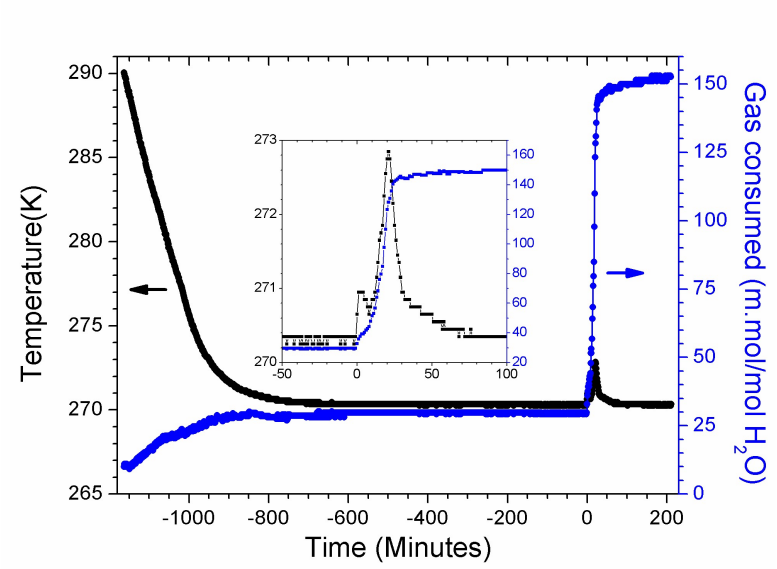

Figure 1: Observed temporal variation in temperature and methane gas consumed during the hydrate formation (cycle# 1) in SiO_2 – H_2O – CH_4 system. Inset shows the hydrate onset and growth event in expanded time scale.

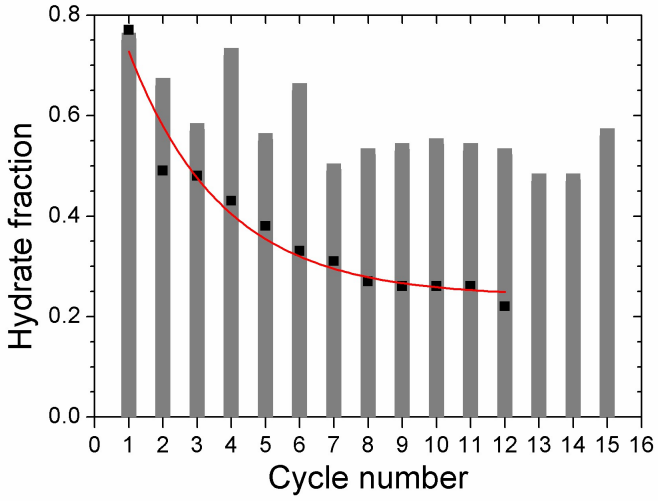

Figure 2: Estimated hydrate fraction in SiO_2 – H_2O – CH_4 system in different freezing and thawing cycles. The vertical bars are from the current study, while the squares are the data reported by Park et al for dry water system (*J Phy Chem C*., **119**, 1690 – 1699, 2015). The red line is the exponential decay fit to Park et al's data.