

Adhesion Behaviors at Hydrate-Water Interfaces

Jae W Lee^{C, S}

Chemical and Biomolecular Engineering, KAIST, Daejeon, Korea
jaewlee@kaist.ac.kr

Current gas and oil production requires exploration of remote locations like off-shore reservoirs as the crude oil and gas resources have been depleted. Harsh conditions of low-temperature and high-pressure at these reservoirs can lead to the formation of clathrate hydrates between water and small gas/organic molecules. The flow assurance issue arising from the hydrate plug formed inside extraction/delivery pipelines imposes major hurdles to the continuous production of gas and oil. Thus, research in the petroleum industry had been focused on inhibiting the formation of gas hydrates. Understanding of the initial hydrate growth, agglomeration, and attachment to surrounding surfaces must be explored through interaction force studies to gain insights for preventing evolution of hydrate plugs. We have proposed a new setup for adhesion force measurements to characterize the interaction behavior of clathrate hydrates and its emulated surroundings.¹⁻² This talk will introduce the updated setup for adhesion force measurements and explain the volume-dependent adhesion behaviors between cyclopentane (CP) hydrate and solution droplet in a CP/n-decane oil mixture by using the z-directional microbalance. The abnormal variations of capillary bridge between CP hydrate and solution droplet due to hydrate formation will also be visualized through an optical microscope and will be directly quantified in a microbalance.

References

- [1]. Song, J. H.; Couzis, A.; Lee, J. W., Direct Measurements of Contact Force between Clathrate Hydrates and Water. *Langmuir* 2010, 26, (12), 9187-9190.
- [2]. Song, J. H.; Couzis, A.; Lee, J. W., Investigation of Macroscopic Interfacial Dynamics between Clathrate Hydrates and Surfactant Solutions. *Langmuir* 2010, 26, (23), 18119-18124.