Measurements of Solid-Liquid Equilibria in Hydrocarbon Systems

Jordan Oakley [C, S], Brendan Graham, Thomas Hughes, Kenneth Marsh and Eric May
Fluid Science & Resources Division, University of Western Australia, Perth, Western Australia, Australia
jordan.oakley@research.uwa.edu.au

Liquefied Natural Gas (LNG) is a significant contributor towards meeting the continuously mounting global demand for energy. According to Exxon Mobil Corporation [1], the global demand for LNG is projected to rise by 65 % within the next three decades despite the slow demand growth within the last year [2]. This demand is primarily due to the expansion of China, who has become extremely influential in world energy markets due to their ongoing expansion and subsequent increasing energy demand [3]. Consequently, flow assurance within LNG processing facilities has become a major technical and economic issue. The avoidance or remediation of the formation and subsequent deposition of long-chain hydrocarbon (C6+) solids is one key aspect of flow assurance. Under the cryogenic temperatures and high pressures at which LNG processing facilities operate, these hydrocarbons can precipitate out of the LNG and accumulate in the process equipment causing blockages. The ability to predict solids deposition rates depends on many factors, one of which is currently being examined in this work: the thermodynamic equilibrium between LNG and hydrocarbon solids. A commercial differential scanning calorimeter (DSC) was used to determine the melting temperatures for hydrocarbon mixtures containing components analogous to those that precipitate in LNG processing. This apparatus is capable of attaining temperatures as low as 77 K and pressures up to 6 MPa thereby simulating the industrial operating conditions at which precipitation occurs. Melting temperature measurements of LNG analogues under both ambient and plant operating conditions will be presented, together with an analysis of the impact of both solute and solvent composition.

References

[1] Exxon Mobil Corporation, The Outlook for Energy: A View to 2040, *Texas, USA* (2014). Retrieved from http://cdn.exxonmobil.com/~/media/Reports/Outlook%20For%20Energy/2014/2014-Outlook-for-Energy.pdf
[2] International Energy Agency, Natural Gas Information: Beyond 2020, *Paris, France* (2014). Retrieved from http://wds.iea.org/wds/pdf/Gas_documentation.pdf
[3] EIA (Energy Information Administration), China - Analysis, *Washington DC, USA,* (2014). Retrieved from http://www.eia.gov/countries/analysisbriefs/China/china.pdf