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New Data and Models to Avoid Cryogenic Solids Formation in LNG Production

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The formation and deposition of solids during the cryogenic processing of natural gas is a perennial risk for operators. Current tools for predicting heavy hydrocarbon solid formation temperatures suffer from various limitations including restricted composition ranges and/or an inability to represent the available literature data. New measurements of the trace BTEX, CO₂ and H₂O solubilities in multi-component LNG mixtures are essential if more robust predictive models are to be developed. Furthermore, the process gas chromatographs used to protect cryogenic heat exchangers from solids freeze-out do not have the resolution needed to distinguish high- and lower-risk compounds (e.g. benzene Vs hexane), and only provide an indirect indication of risk: the composition measured must still be converted to a freeze-out temperature using a thermodynamic model. We present here outcomes from our ongoing program to help avoid cryogenic solids formation in LNG production. A new software tool called Thermo FAST has been developed and endorsed by GPA Midstream to replace the Kohn-Luks Solids Solubility Program. High-pressure visual cells operating at cryogenic temperatures have been constructed and used to produce new solid-liquid equilibrium data to further validate and extend Thermo FAST. These tools have been used to explore phenomena of retrograde solidification in LNG systems, which may lead to novel methods of mitigating inadvertent solids formation in operating plants. Finally, our efforts to develop a more robust sensor capable of directly assessing heavy hydrocarbon freeze-out risk will be described.

Biography:

Arman Siahvashi is completing a PhD degree in chemical engineering and natural gas processing at the University of Western Australia (UWA). His PhD focuses on the measurement of thermophysical properties of liquefied natural gas (LNG); data which are crucial to solve the issue of plant shutdowns due to blockages caused by the freeze-out of impurities, which is a major problem facing the LNG industry.