Improving Confidence in Hydrate Phase Boundary Predictions for MEG Systems

David Zhu [S] and Bruce Norris
Centre for Long Subsea Tiebacks, Department of Chemical Engineering, The University of Western Australia, Perth, Western Australia, Australia

Eric May
Fluid Science and Resources Division, Department of Chemical Engineering, The University of Western Australia, Perth, Western Australia, Australia

Zachary Aman [C]
Centre for Long Subsea Tiebacks, Department of Chemical Engineering, The University of Western Australia, Perth, Western Australia, Australia
zachary.aman@uwa.edu.au

Hydrate formation is detrimental to offshore energy facilities in deep-water environments as blockages may form in pipelines and subsea equipment. Traditional avoidance strategies are risk-averse, opting to dose thermodynamic hydrate inhibitors (THIs) such as mono-ethylene glycol (MEG). Thermodynamic models capable of predicting the hydrate phase boundary assist operators in determining the THI dosage required to shift operating conditions outside the hydrate forming region. While arbitrary safety margins are applied to ensure complete hydrate formation prevention, no formal assessment of software prediction accuracy has been made that encompasses the swathe of experimental hydrate phase equilibrium data available. As THI operating costs scale significantly with production depth, accurate assessments are vital to identify potential sources of cost-reduction by optimising dosage rates while continuing to operate safely.

A centralised database of over 9,000 experimental data points of hydrate phase equilibria extracted from literature has been constructed. This allowed for the identification of several knowledge gaps in the literature; crucially, a paucity of data for >50 wt% MEG systems, indicating a need for more phase equilibria experiments in this region to validate software prediction accuracy in these systems. Furthermore, from this database, the bias and average absolute deviation of equilibrium temperature from thermodynamic model predictions of MultiFlash® 7.0 are reported for a range of compositions. This will allow for the development of more accurate, composition-specific safety margins. Such improvements will increase confidence in the required MEG dosage for production systems, reducing excess inhibitor capacity in operations. These outcomes are crucial for future operations at greater depths, higher pressure and lower temperatures. With the push towards risk management, increased confidence in thermodynamic boundaries will be key for attempts to operate safely in an under-inhibited regime.