

Mutual Solubility of Water and Hydrocarbons

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The accurate estimation of water-hydrocarbon vapour-liquid and vapour-liquid-liquid equilibrium is an important activity related to safe and reliable design of industrial equipment. Currently heavy, highly aromatic oil fractions are of interest due to the use of bitumen and heavy oil as feedstock and proper estimates for water in hydrocarbon, hydrocarbon in water and hydrocarbon in air concentrations are key parameters for process design and evaluation of new processes such as high temperature thermal upgrading using supercritical water. In addition to heavy hydrocarbon feedstock processing the correct estimation of water solubility in gaseous hydrocarbons as well as in liquid hydrocarbons is of interest for the gas production and midstream industries due to the possibility of gas hydrate formation in pipelines and ice formation in cryogenic distillation towers and the associated safety and efficiency problems. In addition, novel separation processes based on the formation of hydrates and ice require accurate quantitative models that can be used to calculate the amount of solids formed together with accurate fluid phase models for the calculation of water concentrations in the gas and liquid phases at equilibrium. In this paper we present a simple and accurate equation of state model used for the calculation of water solubility in gas or liquid hydrocarbons, solubility of hydrocarbons in water and its use for the calculation of vapour-liquid-solid equilibrium. The model can be used to represent aqueous systems at low and high temperatures, is simple to use, can be used for the computation of consistent phase envelopes and is extensible to other types of mixtures.