A generalized thermodynamic correlation based on three-parameter corresponding st...

Engineering

A Generalized Thermodynamic Correlation Based on Three-Parameter Corresponding s There is a correlation between thermodynamic and volumetric functions. The article by Byung IK Lee and Michael G. Kesler elaborates a generalized correlation basing on the three corresponding states. The three states were proposed by Pitzer and his co-workers. The three states are fundamental and widely used in process design. The original work by Pitzer basing on the same principle was designed within a temperature limit of 0. 8. Since then, there have been the development of various correlation in the last five years which have been presented in tabular form but, unfortunately, they cannot be implemented in computers (Lee and Kesler). Moreover, there are discrepancies existing between the extended and the original correlations' interface.

The main objectives of the paper are the development of the analytical correlations basing on the stated three – parameter corresponding state principle. Also, the work is aimed at covering the whole range of Tr and Pr in the practical application of hydrocarbons processing (Lee and Kesler). Furthermore, the work focuses on the improvement of consistence and accuracy of the pre-existing correlations. The achievement of the above stated objectives was based on the two state equations that are similar to Rubin, Benedict and general fluid reference (Lee and Kesler).

In the paper, there is the description of the methodologies that can be efficiently used in the in the representation of the thermodynamic functions and volumetric functions. The description is based on the on the 3-parameter corresponding state principle proposed by Pitzer (Lee and Kesler). The functions referred in the description include fugacity coefficients, densities,

enthalpy departures, isochoric and isobaric. The description of the methodologies has resulted in the generation of two equations of state that can be effectively used for reference fluids and the two equations are adequately used to represent both the thermodynamic and volumetric properties of both vapour and fluids as a function of the pre-stated 3-parameters within a range where Tr = 0. 3 to Tr = 0. 4 and Pr = 0 to Pr = 10. Using the above stated analytical form, there is an improvement in the representation of the properties at critical regions and within low temperatures (Lee and Kesler).

The article concludes that, the stated methods are reliable and due to this; they have found wide applications in various in various conditions. Also, it is connoted that the accuracy of the methodologies can be compared to the original Pitzer correlations, and the accuracy is best in sub cooled and superheated regions. Despite this, there is a small discrepancy in the accuracy when compared to Pitzer correlations in some conditions. This diminishing accuracy occurs at saturated conditions and retrograde and critical regions during its application in widely boiling mixtures (Lee and Kesler).

References

Lee, Byung Ik and Michael G. Kesler. " A Generalized Thermodynamic Correlation Based on Three-Parameter Corresponding States." AIChe Journal (1975): 511-527. Elcectronic.