



International Conference on Oil, Gas and Petrochemistry

April 3-5, 2017 Dubai, UAE

A new cubic equation of state for better liquid-phase density prediction

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Hydrocarbon fluid phase behaviors have numerous implications in natural gas and petroleum engineering and are often predictable from equations of state (EOSs). Equations of state methods are far less expensive (in terms of material cost and time) than laboratory or experimental forages and the results are interestingly within acceptable limits of accuracy.

A new three parameter cubic EOS was developed based on a modification of the van der Waals (vdW) attraction term contribution to pressure. The success of the new EOS was derived from recognizing that the attraction term of previous EOSs has been inadequate in capturing the dense fluid properties especially liquid densities and PVT properties at or near the critical region. The primary goal was to minimize the gap between experimentally derived-, and equation of state (EOS)- calculated PVT or fluid phase behavior data especially, liquid densities, (which is very critical especially since it is the major weakness of most popular EOSs) for pure components and mixtures.

Volumetric and phase equilibria calculations were carried out with the new EOS for pure components, binary ternary and multicomponent mixtures and results compared to experimental data (available in literature) and results obtained from industry-popular cubic EOSs, in particular, PR and PT EOSs. The results indicate that the new EOS predicts the liquid densities of pure hydrocarbon components and mixtures more accurately than the PR and PT EOSs. The new EOS proved superior to the popular industry EOSs in the prediction of liquid phase densities of pure components and mixtures with a grand average percent absolute deviation (AAPD) of 1.60% as opposed to 3.01% and 11.17% for PT and PR EOSs respectively.

Biography:

Dr. Princess Nwankwo has a B.Sc and M.Sc in Pure and Analytical Chemistry, respectively and a post graduate diploma, M.Sc. and PhD in Petroleum Engineering. Her PhD in Petroleum and Natural gas Engineering was obtained her PhD in December, 2014 from Penn State University under the supervision of Prof. Michael Adewumi and Prof. Thaddeus Ityokumbul. Dr Princess Nwankwo was a beneficiary of the Schlumberger's Faculty for The Future (FFTF) grant for women in University education. She is a mother of three children and presently lectures at the Department of Petroleum Engineering, University of Ibadan, Ibadan in Nigeria.