

A Two-Parameter Correlation of the Saturated Liquid Density: Modification of the Chouaieb-Ghazouani-Bellagi Correlation

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In this study, a modification of the Chouaieb-Ghazouani-Bellagi (CGB) correlation of the saturated liquid density is proposed. We examined the critical exponent, which is a non-linear parameter for the CGB correlation. We found that the empirical values of the exponent are distributed in a narrow range and their average is close to a theoretical value of 0.325. It was therefore assumed that the exponent is equal to 0.325 plus a small number. Then, a Taylor-series expansion for the CGB correlation is conducted and the first two terms are taken to develop a new correlation of the saturated liquid density as a function of the temperature with two linear adjustable parameters. Data on the saturated liquid density for 74 substances from the NIST Chemistry Webbook in the whole vapor-liquid saturation range are fitted to the new correlation to yield an average AAD of 0.31%. The results compare well with those of the existing two-parameter correlations, viz., the generalized Guggenheim (0.28%) and the original CGB (0.31%). It is noted that the CGB correlation is successfully and conveniently linearized without a noticeable degradation in performance. If the variation in the critical exponent is ignored, we have a single-parameter correlation for which the average AAD is 0.52%, which shows a minor improvement over the modified Rackett equation of Spencer and Danner (0.60%). The correlations proposed in this work are valid over the entire temperature range where data-points exist.