

Helmholtz Energy Model for Fluid Mixtures

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In this communication, we present the results of the application of a Helmholtz energy model to the calculation of thermodynamic properties of a variety of fluid mixtures.

The model we used [1] gives the mixture residual Helmholtz energy as the contribution of two terms. The first term is given by an extended corresponding states (ECS) model, whereas the other is a correction term. The ECS model is based upon temperature- and density-dependent shape factors relative to methane and is extended to mixtures by means of the van der Waals one-fluid model with adjustable binary interaction parameters. The correction term depends on temperature and density, and incorporates local composition (LC) mixing rules from an LC model from the generalized van der Waals partition function and a coordination number model for square-well fluids. The mixture model incorporates five adjustable coefficients.

We applied the mixture model to a wide variety of systems with the following results. For binary mixtures of the primary components of natural gas systems in the intervals from 90 to 675 K and pressures up to 500 MPa, the overall AAD was 0.12 % for densities, 0.16 % for speeds of sound, and 1.8 % for bubble-point saturation pressures. For natural gas systems, the overall AAD's were 0.030 % for densities and 0.049 % for speeds of sound. For air, we obtained overall AAD's of 0.10 % for densities, 0.22 % for speeds of sound, and 0.39 % for bubble-point saturation pressures. For liquefied natural gas mixtures, the AAD in saturated-liquid densities was 0.09 %. These results compare quite satisfactorily with those from reference models [2,3,4].

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