

Helmholtz Energy and Extended Corresponding States Model for Refrigerants and Mixtures of Refrigerants

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This work presents an overview of the results obtained with Helmholtz energy and extended corresponding (ECS) models for refrigerants and mixtures of refrigerants. In the proposed model, the mixture Helmholtz energy is represented by a term from an ECS model plus a correction term. The ECS term is based on temperature- and density-dependent shape factors relative to the Tillner-Roth and Yokozeki reference equation of state for R-32 and the correction term is a temperature- and density-dependent mixing rule. The model was applied to 19 refrigerants of the methane, ethane and propane series and to mixtures of R-32, R-125, R-134a, R-143a, and R-152a. The model was tested against a total amount slightly exceeding 130,000 data and representative results, in terms of overall percentage average absolute deviations, were: for pure fluids: 0.187 in densities, 0.229 in vapour pressures and 0.662 in speeds of sound; for binary mixtures: 0.347 in densities, 0.467 in bubble-point vapour pressures and 0.077 in speeds of sound. Compared to the equations of state for technical applications, these results are satisfactory and allow concluding that the proposed model is an alternative in the context of technical applications.