Evaluation of Different Predictive Mixture Models by Means of a Refrigeration Cycle

Andreas Jäger [C, S], Erik Mickoleit and Cornelia Breitkopf
Technical Thermodynamics, TU Dresden, Dresden, Saxony, Germany
andreas.jaeger@tu-dresden.de

Global warming leads to an increasing need to identify new working fluids for processes in power and process engineering in order to replace existing working fluids with high global warming potential (GWP). For example, according to EU regulation No. 517/2014, some currently used refrigerants having a GWP above a certain threshold may no longer be used or put on the market in the European Union. Pure fluids as working fluids have been studied quite extensively; however, mixtures of working fluids have not been investigated in depth yet. As an infinite amount of mixtures exists, it is not possible to investigate all of these mixtures experimentally for their suitability to replace existing working fluids in a certain process. Therefore, accurate mixture models with good predictive capabilities are required in order to identify promising candidates for mixtures of working fluids.

In this work, several commonly used predictive mixture models that are available in the thermophysical property software TREND 4.0 have been used to calculate performance parameters of a simple refrigeration cycle (split air conditioner with internal heat exchanger) for three refrigerant mixtures, i.e., R-410A, R-421A, and R-507A. The results of these predictive mixture models (the multi-fluid mixture model with and without a theoretically based departure function, cubic equations of state, the Lee-Kesler-Plöcker equation of state, as well as the PCP-SAFT equation of state) have been compared to the results when using the reference mixture models for these mixtures. It was found that some of the performance parameters are mostly influenced by the choice of the equations of state for the pure fluid and some are mostly influenced by the choice of the mixture model. The largest deviations occur for the size and performance parameter *UA* of the internal heat exchanger.