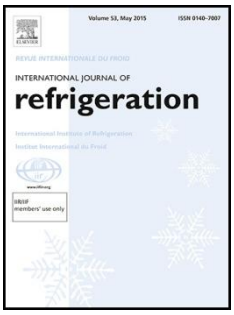
Accepted Manuscript



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PII: S0140-7007(17)30377-8
DOI: https://doi.org/doi:10.1016/j.ijrefrig.2017.09.021
Reference: JIJR 3761

To appear in: *International Journal of Refrigeration*

Received date: 26-4-2017
Revised date: 23-8-2017
Accepted date: 25-9-2017

Please cite this article as: Meng Wang, Tim M. Becker, Carlos A. Infante Ferreira, Assessment of vapor-liquid equilibrium models for ionic liquid based working pairs in absorption cycles, *International Journal of Refrigeration* (2017), https://doi.org/doi:10.1016/j.ijrefrig.2017.09.021.

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Assessment of Vapor-Liquid Equilibrium Models for Ionic Liquid based Working Pairs in Absorption Cycles

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Highlights

- RK EOS is recommended in correlating VLE data and estimating mixing enthalpies in absorption cycles.
- The mixing of liquid NH_3 with IL is less exothermic than that of H_2O with IL.
- The total enthalpy of the studied NH_3/IL solution is less sensitive to VLE models than that of the studied H_2O/IL solution.
- A lower estimation of the mixing enthalpy leads to an overestimated cycle COP.

Abstract

This paper assesses the performance of vapor-liquid equilibrium (VLE) models in ionic liquid based absorption cycles with natural refrigerants. Frequently used equation-of-state (EOS) based models, activity coefficient based models, and generic Clausius-Clapeyron relations are evaluated. Working pairs considered are H_2O/[emim][DMP] and NH_3/[bmim][BF_4]. Firstly, experimental VLE data of those working pairs are correlated by using the models. Mixing enthalpies are then estimated using the models and corresponding correlated parameters. Performances of the different models in reproducing VLE data and estimating mixing enthalpies are compared with each other. Subsequently, total enthalpies and thermodynamic performances of absorption refrigeration cycles are predicted based on the different models. The assessment reveals that the RK-EOS and the NRTL model perform best in reproducing VLE data. In addition, the RK-EOS and the UNIFAC model show the best performance in estimating mixing enthalpies. Hence, the RK-EOS is recommended in correlating VLE data and estimating mixing enthalpies in absorption cycles.