Power generation from waste heat: Ionic liquid-based absorption cycle vs. organic Rankine cycle

Jiaming Xu[1], Aaron Scurto[2], Mark Shiflett[3], Steven Lustig[1], and Francisco Hung[1]

[1]Northeastern University
[2]University of Kansas
[3]The University of Kansas

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Abstract

Aspen Plus® simulations using the Peng-Robinson (PR-EOS) and the COSMO-SAC models were performed to study absorption power cycles (APCs) using mixtures of R-134a with two ionic liquids, [C2C1im][Tf2N] or [C6C1im][Tf2N], and compared against an R-134a organic Rankine cycle (ORC) operating under similar conditions. The PR-EOS results were in agreement with calculations from a PR model fitted to the R-134a+IL experimental phase equilibrium data. The APCs have similar efficiencies and outperform the ORC by 3-46%, with the largest differences observed when operating with lower grade (lower TH) heating sources, lower quality cooling (higher TL) and lower subcooling in the pump inlet stream. The PR-EOS and the COSMO-SAC results follow similar trends, but numerical discrepancies are observed in the cycle efficiencies and stream flow rates and compositions due to differences in solubilities and enthalpy changes between both models, suggesting that improvements are needed to increase the accuracy of COSMO-SAC for these systems.

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