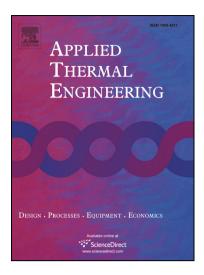
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A novel chemical heat pump cycle for cooling and heating

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Abstract: The absorption heat pump cycle based on LiBr/H₂O has shortcomings of easy crystallization, severe corrosion, and the limitation in the temperature rise. In this study, a novel chemical heat pump cycle is proposed to overcome these issues. The thermal performance of the chemical heat pump using NaNO₃/H₂O is simply calculated for communication. The results show that the chemical heat pump can work at a lower generating temperature of 73.9 °C and avoid the crystallization issue when simultaneously supplying heating and cooling at 60 °C and 7 °C, respectively. Moreover, the annual corrosion rate of carbon steel in the NaNO₃/H₂O strong solution is only 7.09 μ m y⁻¹ at 180 °C. The chemical heat pump has the advantages of lower generating temperature and corrosiveness, as well as larger temperature operating range and temperature rise in comparison to the absorption cycle using LiBr/H₂O and other alternative working pairs. However, the chemical heat pump has a lower thermal performance, and the *COPc*, *COP*_h, and *COP*_o are 0.11, 1.11, and 1.22, respectively. In the future studies, it is expected that the chemical heat pump will achieve a much higher *COP*, after taking into account of a multiple-effect cycle, as well as a chemical refrigerant with a larger dissolution enthalpy and solubility slope.

Keywords: Chemical heat pump; chemical refrigerant; thermodynamic properties; thermal performance

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