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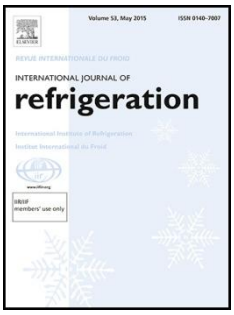

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Heating performance characteristics of CO_2 heat pump system for electrical vehicle in a cold climate

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Highlights

- The heat pump with CO_2 refrigerant achieved good heating performance for a cold climate.
- The impact of six influence factors on CO_2 heating performance characteristics was investigated.
- The system performance of a secondary loop heat pump was experimentally compared with that of the original heat pump.
- Exergy analysis revealed that the largest irreversibility happened in the indoor gas cooler.

Abstract

This study investigated the heating performance characteristics of a CO_2 heat pump system for an electrical vehicle in a cold climate. Experimental tests evaluated the effects on system performance of outdoor temperature, outdoor air velocity, indoor temperature, indoor air flow rate, compressor speed, and EXV opening. The results of heating experiments when both the indoor and outdoor temperatures were -20 ℃ showed a coefficient of performance (COP) of 3.1 and a heating capacity of 3.6 kW. The COP was 1.7 when the outdoor, indoor air inlet, and outlet temperature were -20 ℃, 20 ℃, and 40 ℃, respectively. Therefore, the heat pump using CO_2 refrigerant achieved good heating performance in a cold climate. Additionally, a new secondary loop heat pump was also compared with the conventional heat pump, and the test results show that use of the secondary loop heat pump reduced COP by 19%.

Key words: Electrical vehicle; Heat pump; CO_2 refrigerant; Trans-critical; Heating performance

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