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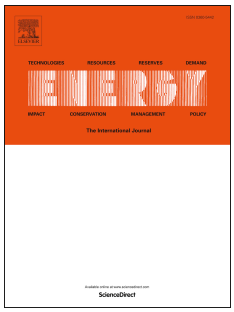

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Hybrid Auto-cascade Refrigeration System Coupled with a Heat-Driven Ejector Cooling Cycle

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Abstract: The hybrid auto-cascade refrigeration system with an integrated ejector cooling cycle (HACRS) driven by high-grade power and low-grade heat simultaneously is developed in this paper. The working fluid applied in the system is a zeotropic refrigerant mixture of R170/R600a. The heat-driven ejector cooling cycle is employed to the auto-cascade refrigeration cycle to form a novel hybrid auto-cascade refrigeration system coupled with an ejector cycle (HACRS). The ejector is applied to increase the suction pressure of the compressor, and cooling capacity from the ejector cycle is also utilized by the evaporative-condenser and dephlegmator in the HACRS. The system performance is evaluated, based on the mathematical model of the system from the principle of mass and energy conservation. The results indicate that energy consumption of the compressor in HACRS could be reduced by 50% as compared to that in the conventional auto-cascade refrigeration cycle (ACRC). The HACRS can use the heat-driven ejector cycle and the recovery of exhaust waste heat of the compressor to improve its mechanical coefficient of performance (COP_{me}) effectively.

Keywords： Auto-cascade refrigeration; Ejector; Compression ratio; Entrainment ratio; Coefficient of performance (*COP*)

Nomenclature

HACRS	Hybrid auto-cascade refrigeration system
ACRC	Conventional auto-cascade refrigeration cycle