Extended Abstract

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Exhaust gas heat-driven steam ejector refrigeration for an automobile

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Abstract:

Steam ejector refrigeration systems are a promising tool for energy efficiency. The aim of this paper is to design exhaust gas heat-driven ejector cooling system in an automobile. The system uses water as the working fluid. The water will be boiled in waste heat boiler by exhaust gas heat and sent to steam ejector utilized instead of compressor in conventional refrigeration systems. At various speed of an automobile, COP (Coefficient of Performance) and cooling capacity is investigated. Therefore, cooling is provided in evaporator, although COP is quite low in ejector refrigeration cooling system, the fuel consumption and greenhouse gas emissions is reduced in the ejector refrigeration system. In addition to energy efficiency, since this refrigeration system has a compressor, it operates under low sound levels and provides less maintenance. An ejector refrigeration (ER) system using exhaust waste heat of a heavy vehicle engine is investigated. A program is developed using engineering equation solver software and it is used to make the calculations of the system. The system is taking all the efficiencies of system's components into account. Refrigerants R134a and R245fa are used for the comparative simulation of the system. The pressure at the exit of the pump is varied from 6 to 14 MPa and 3 to 10 MPa for R134a and R245fa, respectively. It can be concluded that COP (coefficient of performance) of the system gradually increases with the increase in pump exit pressure. Results show that, the performance of the system would be higher if R245fa is preferred rather than R134a with the given operating conditions. Ejector refrigeration is a thermally driven technology which utilizes low grade thermal energy for its operation. This paper experimentally investigates the performance analysis of ejector refrigeration system with R404A as refrigerant. The ejector refrigeration system used exhaust emission of automobile as thermal energy for providing heat to refrigerant in the generator. Effect of different operating parameters on the performance of system has been investigated. The result shows that system using R404A as refrigerant can be used in the ejector refrigeration system for area ratio 7.84. Cooling capacity of the system increases with increase in evaporator temperature and generator temperature. With the escalating production of automobiles, energy efficiency and environmental friendliness have always been a major concern in the automotive industry. In order to effectively lower the energy consumption of a vehicle, it is essential to develop air-conditioning systems that can make good use of combustion waste heat. Ejector refrigeration systems have become increasingly popular for this purpose due to their energy efficiency and ability to recycle waste heat. In this article, the elements affecting the performance of a typical ejector refrigeration system have been explored using both experimental and numerical approaches. For the first time, the internal flow structure was characterized by means of comprehensive numerical simulations. In essence, three major sections of the steam ejector were investigated. Two energy processes and the shock-mixing layer were defined and analyzed. The results indicated that the length of the choking zone directly affects the entertainment ratio under different primary fluid temperature. The optimum entertainment ratio was achieved with 138 ◦C primary fluid temperature. The shock-mixing layer was greatly affected by secondary fluid temperature. With increasing of back pressure, the normal shock gradually shifted from the diffuser towards the throat, while the shock train length remains unchanged.

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