STUDY OF THERMOELECTRIC COOLER

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Abstract— hermal performance of thermoelectric cooler is investigated experimentally. Thermoelectric cooling system is applied to many of engineering applications, the experimental test loop is deranged and providing under different operating condition. The effect of operating Parameters such as the voltage applied and air velocity on the performance of TEC., Experiments are Performed for applied voltage from 3 to 12 volts. And air velocity from 0.0 to 12m/s. The Experimental results showed that the minimum power consumption and maximum coefficient of performance occurs at lower values of the voltage applied.

Keywords— Thermoelectric cooler, COP, Natural convection, Forced convection.

1 INTRODUCTION

THERMOELECTRIC cooling, commonly referred to as cooling technology using thermoelectric coolers (TECs), has advantages of high reliability, no mechanical moving parts, compact in size and light in weight, and no working fluid. In summation, it has advantages that it can be powered by direct current (DC) electricity sources, such as photovoltaic (PV) cells, fuel cells and car DC electric sources. The primary disadvantages of thermo-electric cooling are the high cost and low energy efficiency, which has limited its application to cases where system cost and energy efficiency are less important than energy availability, system reliability and quiet operation environment.. Though thermoelectric cooling effect was discovered in the 19th century, it hadn't come to rapid development until 1950 when the basic science of thermoelectric materials became well established [1].

Recently, Liu et al. [2] performed a liquid-like behavior of copper ions around a crystalline sub lattice of Se in Cu2-xSe by The thermal conductivity which enables high ZT in this simple semiconductor. The outcomes indicate a novel scheme and management for high-efficiency thermo-electric materials by exploring systems where there exists a crystalline sub lattice for electronic conduction surrounded by liquid-like ions.

Chua et al. [3] studied the relationship between temperature and entropy. The entropy density was used to explain the capacity of thermo-electric cooling and thermo-electric heat generation.

Yang and Chen [4] analyzed the cooling capacity of one- and two-stage thermo-electric micro coolers without considering the Thomson effect and showed that the techniques of integrated circuit and micro electromechanical manufacturing are two primary skills for thermo-electric cooling development.

Ni et al [5] ran out an experimental subject of a thermoelectric conversion unit consisting of commercially available TEMs incorporated in a parallel plate heat exchanger.

Izam et al [6] studied the experimental a thermoelectric generator observed in the higher temperature raised a timeless constant temperature source (heat added), the less power abroad and shows the measured decrease in the current less resistance and thermal losses

Adeyanju et al. [7] carried out a theoretical and experimental analysis of a thermoelectric beverage chiller. The comparison was also formed between the thermo-electric beverage chiller's cooling time with cooking times obtained from the freezer space and cold space of a household refrigerator. The result establishes that for the refrigerator, freezer space, the temperature of the water decreased linearly with increasing time and for thermo-electric beverage chiller the temperature of the water decreased exponentially with increasing time.

Wahab et al. [8] Designed and developed an affordable thermo-electric refrigerator powered by solar cells generated DC voltage for the desert people living in Oman where electricity is not usable. In the study, the researchers used 10 nos. Of thermoelectric module in design of refrigerator. The finned surface (heat sink) was utilized to enhance and increase the charge per unit of heat transfer from the hot surface of the thermo-electric module. Cooling fan was used to eliminate the high temperature from the hot side of the module to ambient surroundings. The observational data accumulated from running one thermo-electric module indicate that it is possible to achieve temperature differences up to 26.60C at current 2.5 A and voltage 3.7 V. The coefficient of performance of the refrigerator was calculated and found to be approximately 0.16. An observational work on cooling performance of a developed combined Solar Thermo-electric- Adsorption cooling system has been taken out by Abdullah et al.

Min et al. [9] developed a number of prototype thermoelectric domestic-refrigerators with different heat exchanger combination and evaluated their cooling performances in

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