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PELTIER TECHNOLOGY

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ABSTRACT

In the field of military and medical science there are refrigerators used to cool samples or specimens for preservation. They include refrigeration units for storing blood plasma and other blood products, as well as vaccines and other medical or pharmaceutical supplies. They differ from standard refrigerators used in homes or restaurant because they need to be very hygienic and completely reliable. However, in case of transportation of component from one place to another place there is no refrigeration system. Due to such problem, portable refrigeration system is to be used. Thermoelectric refrigeration is new alternative because it can convert waste electricity into useful cooling, is expected to play an important role in meeting today fossil energy challenges. Therefore, thermoelectric refrigeration is greatly needed, particularly for developing countries where long life and low maintenance are needed. Thermoelectric devices are solid state devices. They are reliable energy converters and have no noise or vibration as there are no mechanical moving parts. They have small size and are light in weight. As refrigerators, they are friendly to the environment as CFC gas or any other refrigerant gas is not used. Due to these advantages, the thermoelectric devices have found a large range of applications. In this paper, basic knowledge of the thermoelectric devices and an overview of these applications are given.

Keywords: Refrigeration, Thermo-electrical system, Peltier effect .

I INTRODUCTION

Air-conditioner (AC) has become almost indispensable for every family, but the traditional air-conditioner has some disadvantages as following:

1) Traditional AC systems consume too much energy. To meet their demands, natural resources are burned to generate electricity, which causes greenhouse effect and to exacerbate a lot of pollution on the earth.
2) The refrigerant of traditional air conditioner, Freon, once leaked, will cause irreversible damage to the ozone sphere and make life suffer from ultraviolet radiation.

II MATERIAL REVIEW

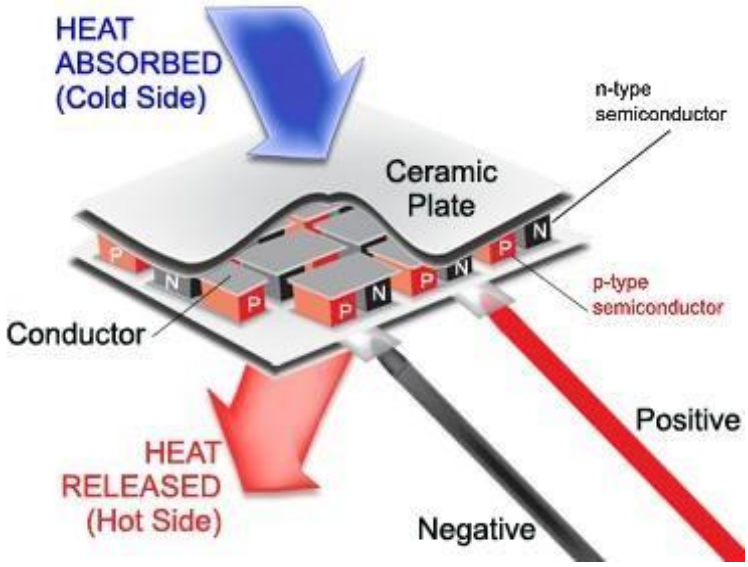
Thermoelectric module is made of two different semiconducting materials, which generate thermoelectric cooling effect (Peltier effect) when a voltage of similar po larity & in appropriate direction applied through the connected junction. Two heat sinks & fans are attached to hot and cold sides of thermoelectric module in order to enhance heat transfer and system performance. There exists optimum current & optimum voltage for maximum coefficient of performance (COP) for a specific module and fixed hot/cold side temperatures.

THERMOELECTRIC COOLING

In Thermo-electrical refrigeration system, the Peltier effect is the phenomenon of to create a heat flux between the junctions of two different types of materials. A Peltier heater, cooler or thermoelectric heat pump is a solid- state active heat pump, which convert heat from one side of the device to the other, with consumption of electrical energy, depending on the direction of the current. Such an instrument is also called a Peltier device, Peltier heat pump, solid state refrigerator, or thermoelectric cooler (TEC). The main advantages of a Peltier cooler are its lack of moving parts or circulating liquid, near-infinite life and potential to avoid leaks, and its small size and flexible shape. Its main disadvantage is high cost and poor power efficiency. Many researchers and companies are trying to develop Peltier coolers that are both cheap and efficient.

PELTIER EFFECT

A Peltier cooler can also be used as a thermoelectric generator. When operated as a cooler, a voltage is applied across the device, and as a result, a difference in temperature will build up between the two sides.



When operated as a generator, one side of the device is heated to a temperature greater than the other side, and as a result, a difference in voltage will build up between the two sides.

III WORKING PRINCIPLE

Peltier elements are thermoelectric components capable of pumping heat from one end of the device to the other end based on the direction of current. An advanced Peltier element comprises several thermocouples that are electrically connected by copper bridges in series .Ceramic plates made of aluminium oxide are used to thermally bond the copper bridges. However, the copper bridges are electrically separated from each other. Peltier elements is made up

of p type Si- n type Si.

Performance specification

Hot Side Temperature (°C)	25°C	50°C
Qmax (Watts)	50	57
Delta Tmax (°C)	66	75
Imax (Amps)	6.4	6.4
Vmax (Volts)	14.4	16.4
Module Resistance (Ohms)	1.98	2.30

FEATURES OF PELTIER MODULE

1) Peltier module can convert thermal energy into electricity, or when electricity is provided to the peltier module then absorption of heat(cool side) on one side and rejection of heat(hot side) on other side.
2) Conventional systems can use or generate harmful gasses like Chloro Fluoro Carbons (CFCs) and Hydro Chlorofluorocarbons (HCFCs).The peltier module can't use or generate these harmful gasses.
3) Peltier module can operate on DC power source.
4) By using proper closed loop circuit, the peltier module can control precise temperature.

IV CONCLUSION

This paper reviews the developments in TER system over the years. This study on the thermoelectric refrigeration emphasize that the TER system is a novel refrigeration system which will be a better alternative for conventional refrigeration system. The research and development work carried out by different researchers on TER system has been thoroughly reviewed in this paper. This paper also concludes that, to achieve better COP & temperature control we can combine TER with other refrigeration systems. For example combining VCR & TER systems reduces the energy consumption, gives high COP & good temperature control within the refrigerated area. Hence it is better to have such hybrid systems & devices to reduce total energy consumption.

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