

# Peltier based Air Conditioner

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**Abstract** – The current air-conditioning system does cooling by refrigerant gases such as Freon, CFCs, etc. While these refrigerants provide good output, their major disadvantage is the emission of harmful gases that damage the ozone layer. A way to overcome this issue is by making use of air conditioners that use thermoelectric modules for cooling, which work by Peltier effect. These modules do not emit any harmful agents, thereby protecting the environment. This paper deals with the study of those thermoelectric air conditioners using Peltier module. Thermoelectric air conditioners have multiple advantages over conventional air conditioners, like, they are smaller in size, they weigh less, have high reliability, have no mechanically moving parts and no working fluid.

**Riff and Guoquan** Conducted an experimental study of thermoelectric air conditioners versus vapour compression and absorption air conditioners. Three different types of domestic air conditioners are compared and compact sized air conditioner was fabricated.

**Astrin, Vian & Dominguez** conducted an experiment on the coefficient of performance in the thermoelectric cooling by the optimization of heat dissipation. In thermoelectric cooling is based on the principle of a thermo syphon with phase change is presented. In the experimental optimization phase, a prototype of thermo syphon with a thermal resistance of 0.110 K/W has been developed, dissipating the heat of a Peltier pellet with a size of 40\*40\*3.9 cm, experimentally proved that the use of thermo syphon with phase change increases the coefficient of performance up to 32%.

## 1. INTRODUCTION

Air Conditioning is the science of controlling primarily three parameters of human comfort, temperature, relative humidity and air quality. Air conditioners, dehumidifiers and evaporative coolers serve the purpose however air conditioners are termed expensive and coolers prove ineffective in humid conditions. The study conducted in the work aims at developing a Peltier operated air cooler coupled with a dehumidifier to achieve dual objective of dehumidification and sensible cooling. The work aims to performance testing of Peltier operated air conditioner for indoor cooling. The desired design is intended to provide a good alternative to present Air Conditioners which consume sufficiently high electricity with very large initial investment.

## 2. LITERATURE SURVEY

**Matthieu Cosnier et al** presented an experimental and theoretical study of a thermoelectric air-cooling and heating system. They have reached a cooling power of 50W per module, with a coefficient of performance between 1.5 and 2, by supplying an electricity of 4A and maintaining the 5°C temperature difference between the hot and cold sides.

**Wei He et al** presented Numerical study of Theoretical and experimental investigation of a thermoelectric cooling and heating system driven by solar. In summer, the thermoelectric device works as a Peltier cooler when electricity applied by PV/T modules. The minimum temperature 17-degree C is achieved, with coefficient of performance of the thermoelectric device higher than 0.45. And comparing simulation result and experimental data.

## 3. WORKING

### 3.1. The Peltier effect

Thermoelectric coolers operate according to the Peltier effect. By transferring heat between two electrical junctions it creates the temperature difference. A voltage is applied between joined conductors to create an electric current. When the current flows through the junctions of the two conductors, heat is removed at one junction and cooling occurs. Heat is deposited at the other junction. The main application of the Peltier effect is cooling. However the Peltier effect can also be used for heating. In both cases, a DC voltage is required.

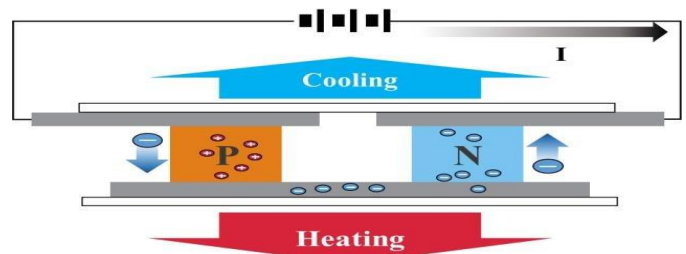


Fig -1: principle of peltier module TEC 12706

### 3.2. The Seebeck effect

The Seebeck effect is a phenomenon in which a temperature difference between two dissimilar electrical conductors or semiconductors produces a voltage difference between the two substances.

### 3.3. Heat absorption

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Cooling effect occurs when the current passes through one or more pairs of elements from n-type to p-type; there is a decrease in temperature at the junction ("cold side"), resulting in the absorption of heat from the environment. The heat is carried along the elements by electron transport and released on the opposite side as the electrons move from a higher-energy state to lower-energy state.

The Peltier heat absorption is given by  $Q = P \cdot I \cdot t$ . Where P is Peltier coefficient, I is current and t is time. A single stage thermoelectric cooler can produce a maximum temperature difference of 70°C. However, II-VI Marlow's Triton ICE Thermoelectric Cooler will chill electronics as much as 2°C below current market offerings.

### 4. CONCLUSIONS

We achieved the goal that in spite of using harmful gas, our project works on simply electricity and we use minimal amount of electricity as compared to modern air conditioner. In spite of using whole big ton AC to cool a room, we used peltier based AC to cool oneself.

It found its application only in electronics cooling etc. But we have seen that there is a huge scope of research in this field of improvement about thermoelectric materials, its fabrication, heat sink design etc. Researcher are working on reducing irreversibility in the systems, because Peltier cooler has more potential which we can see from the vast difference between value of first law efficiency and second law efficiency.

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