HEATING AND COOLING SYSTEM IN FOOD MAINTENANCE SYSTEM USING TEG

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ABSTRACT

The aim of our project is to harness the renewable energy resources to get clean energy. Our project utilizes the solar energy to run a heating and cooling system. It is an eco-friendly project, made by using thermoelectric module. The project supports both heating and cooling. We are going to charge the battery with help of solar panel .The power is used to charge the electrons in it. The module will be heating on one side and cooling on another side.we are having heating and cooling chamber and with the help of fan both the chamber is used for maintain or preserve food.

Keywords: *Water injector, Fuel pump,fuel injector manifold*

INTRODUCTION

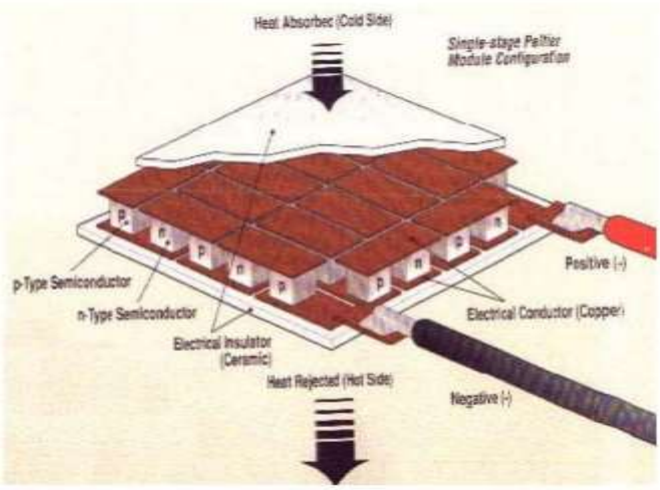
The current tendency of the world is to look at renewable energy resources as a source of energy. This is done for the following two reasons; pressure of the ever increasing world population on our natural energy resources. From these two facts comes the realization that the natural energy resources available will not last indefinitely. Therefore, the ideal solution would be to use some type of renewable energy resource to provide these houses with energy without an expensive electrical grid connection. One solution is a RAPS (the lower quality of life due to air pollution; and, due to the Remote Area Power Supply) using an alternative form of energy**.**

1.1 PURPOSE OF TEG

Thermoelectric refrigeration systems are unique from the three other types of refrigeration in that no refrigerant or water is used. These systems use an electric current and a thermocouple .A thermocouple is made up of two different metal wires that are united at both ends. Insulation separates the rest of the wires from each other. When the current is directed on the thermocouple, one end will become hot and the other cool .Reversing the current's direction has the effect of swapping the cold and hot junctions. The hot end will typically be placed outside of the area to be cooled with a heat sink attached to it to keep it the same temperature as the surrounding air .The cold side, which is below room temperature, is placed in the area to be cooled, attracting heat out of the air. This type of refrigeration is generally used for small cooling loads that can be difficult to access, such as electronic systems.

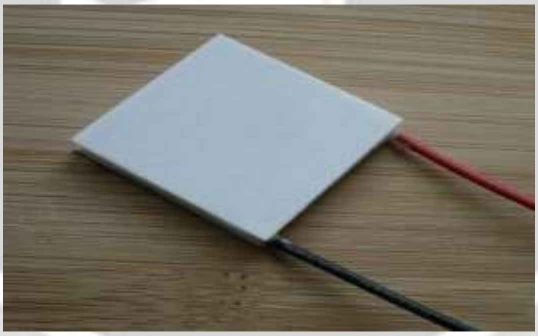
1.2 TEG

Although commercial thermoelectric modules were not available until almost 1960, the physical principles upon which modern thermoelectric coolers are based actually date back to the early 1800s. The first important discovery relating to thermoelectricity occurred in 1821 when German scientist Thomas Seebeck found that an electric current would flow continuously in a closed circuit made up of two dissimilar metals, provided that the junctions of the metals were maintained at two different temperatures. Seebeck did not actually comprehend the scientific basis for his discovery, however, and falsely assumed that flowing heat produced the same effect as flowing electric current. In 1834, a French watchmaker and part-time physicist, Jean Peltier, while investigating the Seebeck Effect, found that there was an opposite phenomenon where by thermal energy could be absorbed at one dissimilar metal junction and discharged at the other junction when an electric current flowed within the closed circuit. Twenty years later, William Thomson (eventually known as Lord Kelvin) issued a comprehensive explanation of the Seebeck and Peltier Effects and described their relationship. At the time, however, these phenomena were still considered to be mere laboratory curiosities and were without practical application. In the 1930s, Russian scientists began studying some of the earlier thermoelectric work in an effort to construct power generators for use at remote locations throughout their country. This Russian interest in thermoelectricity eventually caught the attention of the rest of the world and inspired the development of practical thermoelectric modules. Today's thermoelectric coolers make use of modern semiconductor technology in which doped semiconductor material takes the place of the dissimilar metals used in early thermoelectric experiments. The Seebeck, Peltier and Thomson effects, together with several other phenomena, form the basis of functional thermoelectric modules.



TEG PRINCIPLE OF OPERATION

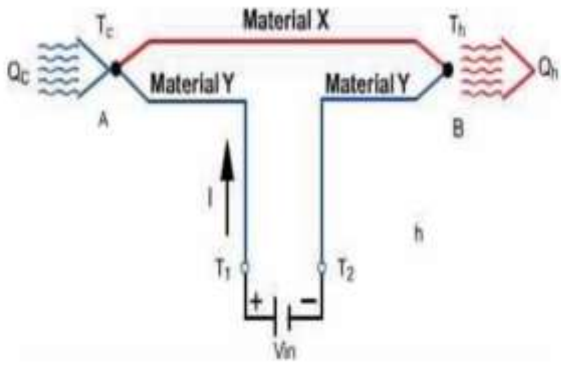
Thermoelectric are based on the Peltier Effect, The Peltier Effect is one of the three thermoelectric effects; the other two are known as the Seebeck Effect and Thomson Effect. Whereas the last two effects act on a single conductor, the Peltier Effect is a typical junction phenomenon. Thermoelectric coolers are solid state heat pumps used in applications where temperature stabilization, temperature cycling, or cooling below ambient are required. There are many products using thermoelectric coolers, including CCD cameras (charge coupled device), laser diodes, microprocessors, blood analyzers and portable picnic coolers. This article discusses the theory behind the thermoelectric cooler, along with the thermal and electrical parameters involves.



TEG MODULE

1.2 PELTIER EFFECT

In 1834, a French watchmaker and part time physicist, Jean Peltier found that an electrical current would produce a temperature gradient at the junction of two dissimilar metals. The Peltier effect is the main contributor to all thermoelectric cooling applications. It is responsible for heat removal and heat absorbance. It states that when an electric current flows across two dissimilar conductors, the junction of the conductors will either absorb or emit heat depending on the flow of the electric current. The heat absorbed or released at the junction is proportional to the input electric current. The constant of proportionality is called the Peltier coefficient.

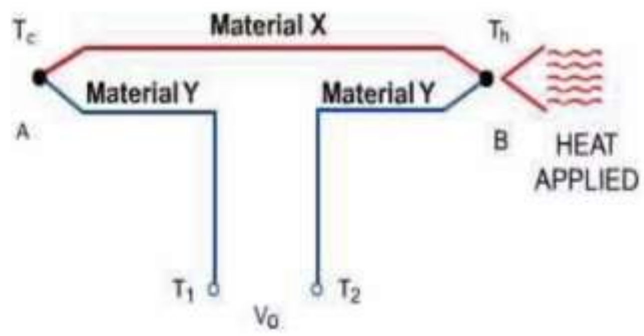


PELTIER EFFECT

1.3 SEEBECK EFFECT

In 1821, Thomas Seebeck found that an electric current would flow continuously in a closed circuit made up of two dissimilar metals, if the junctions of the metals were maintained at two different temperatures. Thermoelectric power supply generators are based on the Seebeck effect which is based on voltage generation along a conductor subjected to a gradient of temperature. When a temperature gradient is applied to a conductor, an electromotive force is produced. The voltage difference generated is proportional to the temperature difference across the thermoelectric module between the two junctions, the hot and the cold one.

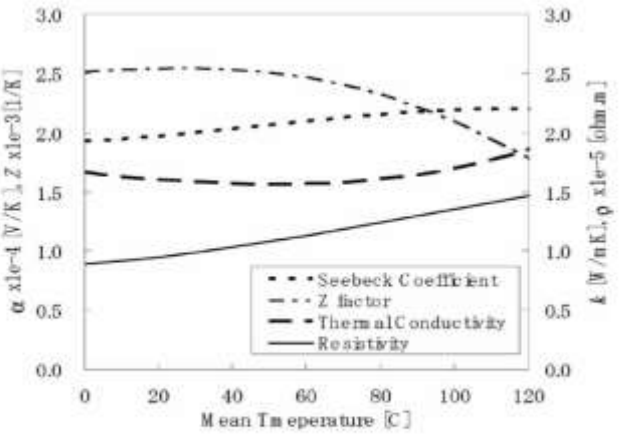
$\Delta V \alpha \Delta T$



SEEBECK EFFECT

2 BIi2 Te3 PROPERTIES

Below is a plot of the figure of merit (Z), Seebeck coefficient, electrical resistivity, and thermal conductivity, as a function of temperature for Bi2Te3 Carrier concentration will alter the values below.



Temperature variation of Bi_2Te_3 material properties

Bi2Te3 figure of merit as a function of tellurium concentration.

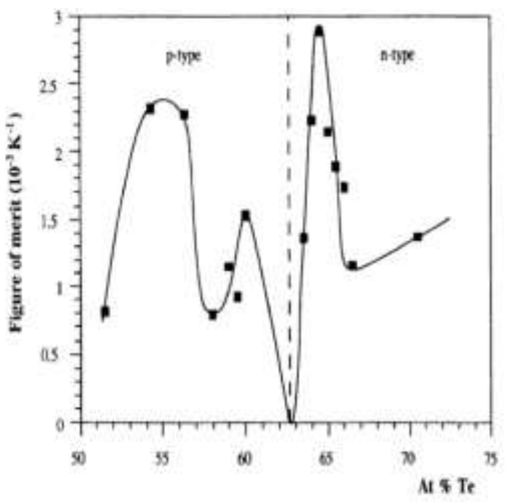


Figure-of-merit as the liquidus composition for both n- and p-type Bi_2Te_3.

3.SOLAR PANEL

In 1897, Frank Shuman a U.S. inventor, engineer and solar energy pioneer, built a small demonstration solar engine that worked by reflecting solar energy onto square boxes filled with ether, which has a lower boiling point than water, and were fitted internally with black pipes which in turn powered a steam engine. In 1908 Shuman formed the Sun Power Company with the intent of building larger solar power plants. He, along with his technical advisor A.S.E. Ackermann and British physicist Sir Charles Vernon Boys developed an improved system using mirrors to reflect solar energy upon collector boxes, increasing heating capacity to the extent that water could now be used instead of ether. Shuman then constructed a full-scale steam engine powered by low-pressure water, enabling him to patent the entire solar engine system by 1912.

Shuman built the world's first solar thermal power station in Maadi , Egypt between 1912 and 1913. His plant used parabolic troughs to power a 45–52 kilowatts engine that pumped more than 22,000 litres of water per minute from the Nile River to adjacent cotton fields. Although the outbreak of World War I and the discovery of cheap oil in the 1930s discouraged the advancement of solar energy, Shuman's vision and basic design were resurrected in the 1970s with a new wave of interest in solar thermal energy . In 1916 Shuman was quoted in the media advocating solar energy's utilization.

Solar power is the conversion of sunlight into electricity, either directly using photovoltaics (PV), or indirectly using concentrated solar power (CSP). CSP systems use lenses or mirrors and tracking systems to focus a large area of sunlight into a small beam. PV converts light into electric current using the photoelectric effect.

Solar power is anticipated to become the world's largest source of electricity by

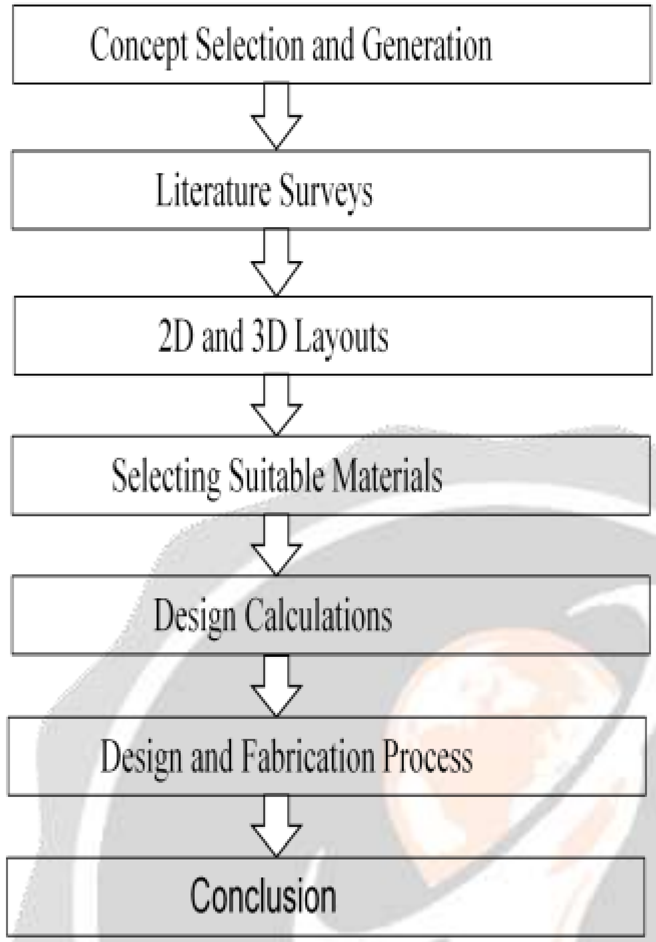
2050, with solar photovoltaics and concentrated solar power contributing 16 and 11 percent to the global overall consumption, respectivel. In 2016, after another year of rapid growth, solar generated 1.3% of global power .Commercial concentrated solar power plants were first developed in the 1980s. The 392 MW Solar Power Facility, in the Mojave Desert of California, is the largest solar power plant in the world. Other large concentrated solar power plants include the 150 MW Solnova Solar Power Station. The 250 MW Agua Caliente Solar Project, in the United States, and the 221 MW Charanka Solar Park in India, are the world's largest photovoltaic plants. Solar projects exceeding 1 GW are being developed, but most of the deployed photovoltaics are in small rooftop arrays of less than 5 kW, which are connected to the grid using net metering and/or a feed-in tariff.

4 CIRCULATING FAN

A fan is a powered machine used to create flow within a fluid, typically a gas such as air. A fan consists of a rotating arrangement of vanes or blades which act on the air. The rotating assembly of blades and hub is known as an impeller, a rotor, or a runner. Usually, it is contained within some form of housing or case. This may direct the airflow or increase safety by preventing objects from contacting the fan blades. Most fans are powered by electric motors, but other sources of power may be used, including hydraulic motors, handcranks, internal combustion engines, and solar power. Mechanically, a fan can be any revolving vane or vanes used for producing currents of air. Fans produce air flows with high volume and low pressure (although higher than ambient pressure), as opposed to compressors which produce high pressures at a comparatively low volume. A fan blade will often rotate when exposed to an air fluid stream, and devices that take advantage of this, such as anemometers and wind turbines, often have designs similar to that of a fan.

CIRCULATING FAN

METHODOLOGY



4.1 WORKING PRINCIPLE

The TEG operating principle is based on the Peltier effect. The Peltier effect is a temperature difference created by applying a voltage between two electrodes connected to a sample of semiconductor material. One of the TEM sides is cooling and the other side is heating. When a TE module is used, you must support heat rejection from its hot side.

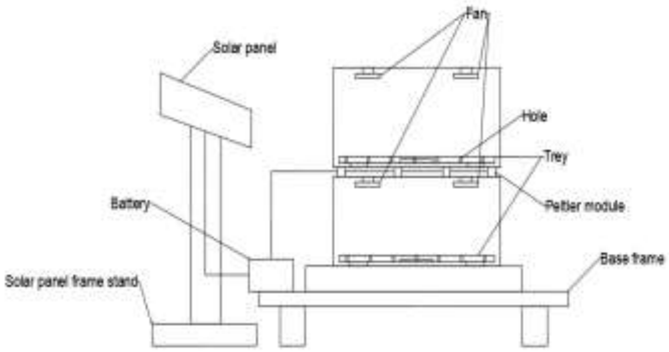
If the temperature on the hot side is like the ambient temperature, then we can get the temperature on the cold side that is lower (tens of Kelvin degrees). The degree of the cooling depends on the current value that is passing through a thermoelectric module. In a thermo-electric heat exchanger the electrons act as the heat carrier. The heat pumping action is therefore function of the quantity of electrons crossing over the p-n junction.

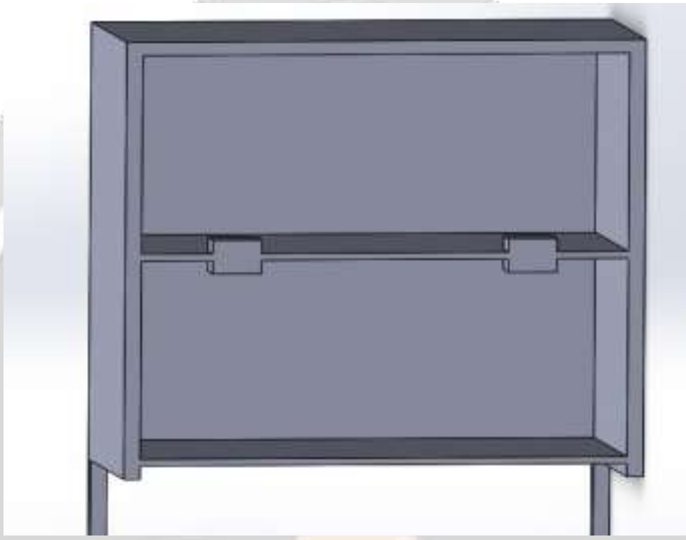
TEG module is in between the heating and cooling chambers. This module gives cooling and heating effects in the chamber. This is used to maintain food in cooling and dry condition. Two fans are attached in between chambers for circulating the cooling and heating.

It may take some time for heating and the cooling operations when the cuurent is passed through the semiconductors there will be emf will be developed and cooling and the heating will be takes place. When the power supply is connected then the fans are said to start working so that the circulation of the air inside the temperature will be takes place.
The food which is placed inside the chamber will be maintained as per the condition according to the heating and cooling takes place.

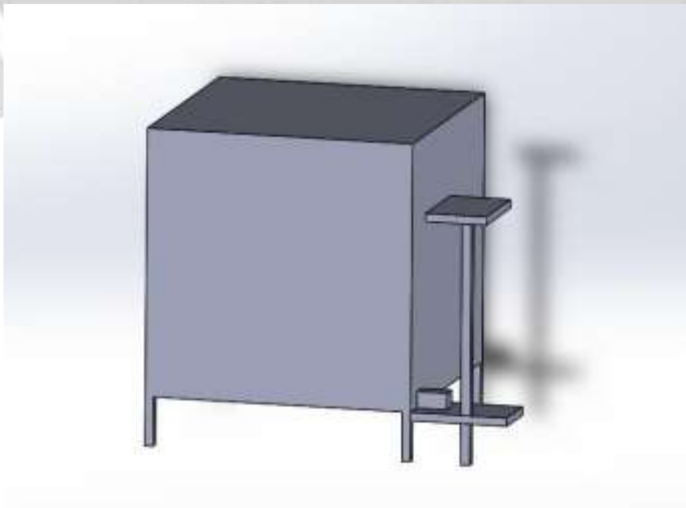
We are using the thermostat which is an temperature sensor for the performance analysis of the TEG. This sensor is used to sense the temperature of the chamber and maintained food and to show the temperature accordingly. As the time increases the heating and the cooling will be increased and the performance of the TEG will be gets increased.

5. LAYOUT





5.1. 3D LAYOUT



5.2 SIDE VIEW

7.CONCLUSION

This project work has provided us an excellent opportunity and experience, to use our limited knowledge. We gained a lot of practical experience regarding, planning, purchasing, assembling and machining while doing this project work. We feel that the project work is a good solution to bridge the gates between institutions and industries. We are proud that we have completed the work with the limited time successfully. The "HEATING AND COOLING OF FOOD USING TEG" is working with satisfactory results. We are able to understand the difficulties in maintaining the tolerances and also quality. We have done to our ability and skill making maximum use of available resourses. In conclusion remarks of our project work, let us add a few more lines about our impression on the project work. Thus, we have developed a "HEATING AND COOLING OF FOOD USING TEG" which helps to know how to achieve low cost automation. The operating procedure of this system is very simple, so any person can operate. By using more techniques, they can be modified and developed according to the applications

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