USING TEMPERATURE DIFFERENCE IN COLDER REGIONS TO GET USEFUL POWER

CONCEPT

There are times when snowstorms or severe bad weather in upper reaches likes that in the Himalayas knock out the power for days altogether and inhabitants of that area lead a very tough life. The situation being faced by these people can be assuaged by using a simple concept that a temperature difference between two regions always means that there is an energy loss, which is occurring and it can be put to useful work. At colder reaches or higher latitudes, it is extremely difficult for human inhabitants to sustain and if there is a snowstorm and the power is knocked out and this makes life more difficult altogether and there are times when there is no power for days. In higher reaches people burn coal/wood to keep warm when the outside temperature could be as low as -15 deg C or perhaps less than that. Under these circumstances living without power makes life miserable and to add to woes it may take days to restore the power provided the snow storm or the bad weather subsides. It is here that the concept of thermoelectricity can effectively be used to generate power.

WORKING

Basic Introduction

A thermocouple is a device/system that is formed when two dissimilar metals are joined at both ends and there is a difference in temperature between the two ends. This difference in temperature creates a small current and is called the Seebeck effect after Thomas Seebeck who discovered this phenomenon in 1821.

FIG 1: THERMOCOUPLE BASIC

In a thermocouple there are two types of junctions, the junction that is put into the process in which temperature is being measured is called the **HOT JUNCTION**. The other junction which is at the last point of thermocouple material and which is almost always at some kind of measuring instrument is called the **COLD JUNCTION**. It is the dT(delta) between the Hot and Cold junction in a thermocouple which generates a milli volt signal. It is this milli volt signal that at present is being used for certain applications like temperature measurement and also can be useful for a variety other applications.

Construction wise there are various types of thermocouple that are available but most common of them are three types, Type E, Type J and Type K Thermocouple. However, a single thermocouple does not produce enough voltage/power so an option turns out in form of a thermopile i.e. connection of thermocouples but again using this setup also not much useful voltage/power can be generated. In this scenario thermoelectric module also know Thermoelectric generator (TEG) turns out to be very useful. TEG's are made up of semiconductor p-n junctions made from bismuth telluride (Bi_2Te_3), lead telluride (PbTe), calcium manganese oxide, or combinations thereof, depending on temperature.

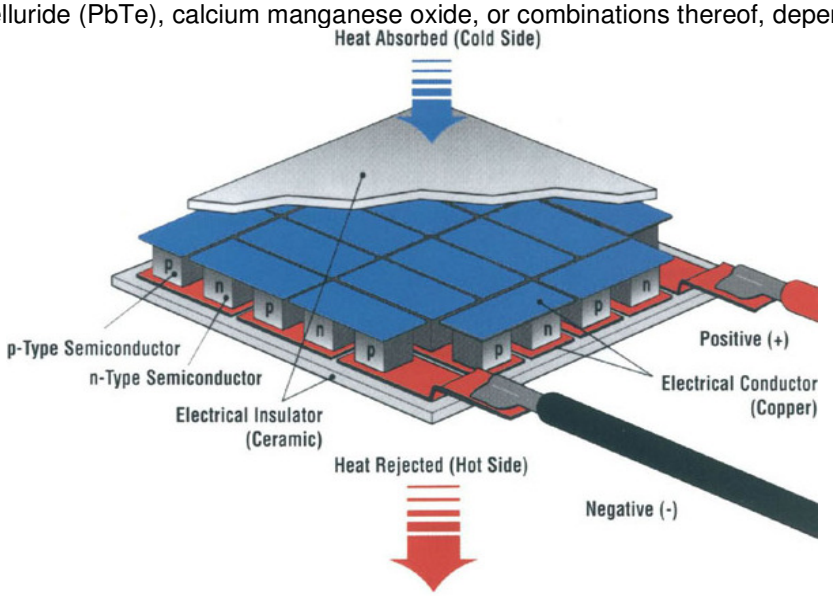

FIG 2: THERMOELECTRIC MODULE (TEG)

Using the dT (delta) temperature in Thermoelectric module (TEG) for generation of Power

When a thermocouple subjected to a temperature difference i.e. the temperature difference between Hot and Cold junction a small electricity is generated and the same concept applies to thermoelectric module. Thermoelectric modules produce electricity directly from flow of heat.

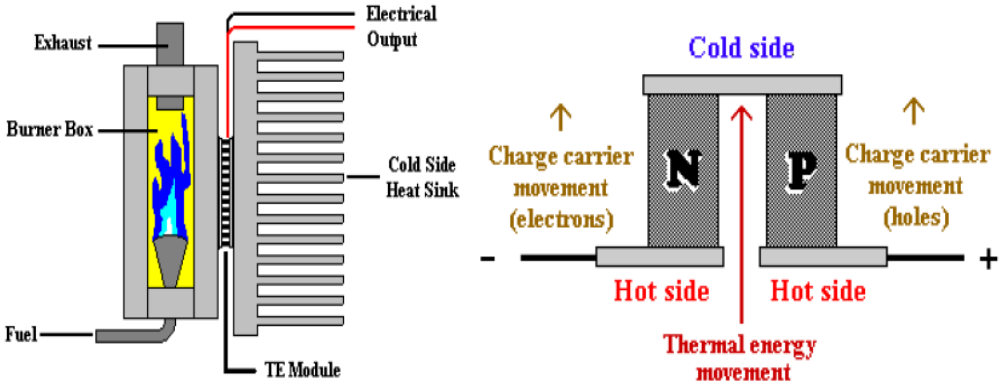

FIG 3: THERMOELECTRIC MODULE CHARGE FLOW

Electrons on the hot side of a material are more energized than on the cold side. These electrons will flow from the hot side to the cold side. If a complete circuit can be made, electricity will flow continuously. Semiconductor materials are the most efficient, and are combined in pairs of “p type” and “n type”. The electrons flow from hot to cold in the “n type,” While the electron holes flow from hot to cold in the “p type.”

Cost

A high temperature bismuth telluride module has a high efficiency of 5%-7% and high operating temperature. This generates 5.9 Watts @ max power and it costs around $10. Connecting more than one thermoelectric module generates a good amount of power, which is sufficient drive minimum load in colder regions when in total dark.

Other Applications

Batteries/cells discharge quite fast in colder regions. This makes Traversing in hilly areas for locals on foot to be a tedious task . Since thermoelectric modules are less in weight they can be easily carried to provide continuous charging of torchlight batteries/cells.

In Industrial units like refineries, steel mills etc. there are boilers/furnaces. There occur huge temperature difference between inside and outside the boilers/furnaces. This temperature can be effectively used to generate power to provide for localized lighting and various other purposes.

CONCLUSION

Hence, using the concept of thermoelectricity effective power can be generated that can be used to power up homes when winter storms or any other calamity knocks out the power as in these areas it can take days altogether to restore the power and it is extremely difficult to live without power for a single day and here we are talking about days altogether. Apart from this the concept of thermoelectricity using thermoelectric module can be used in a variety of applications.

REFERENCES

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