

PIEZOELECTRICITY: KEY WAY TO ALTERNATIVE ENERGY

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Index terms- Piezoelectric Effect, Piezoelectric Materials, Tension and Compression, Piezoelectric Tires, Piezoelectric Generators, Rochelle Salt Crystal Tiles,.

I. INTRODUCTION

Today, we are living in 21st century which is the world of innovation and technology. Whole world is going ahead to a very bright future. To proceed ahead

towards the future, large amount of energy is required. This energy is provided us by means of conventional sources of energy

like Coal. Currently some non-conventional sources are been used like Solar Energy, Wind Energy, Tidal Energy, Hydroelectric Energy, Geothermal Energy. But all of these sources are having certain drawbacks. Nuclear energy is a little solution on these drawbacks but if there is a little problem in the plant then it can harm many cities around itself.

Thus, a need of such a Non-Conventional source of energy is increased which would not only provide us the energy in large amount but also it will also not cause any kind of pollution. In this paper, we are going to introduce you with one such source of energy. The name of this innovative energy source is "PIEZOELECTRICITY".

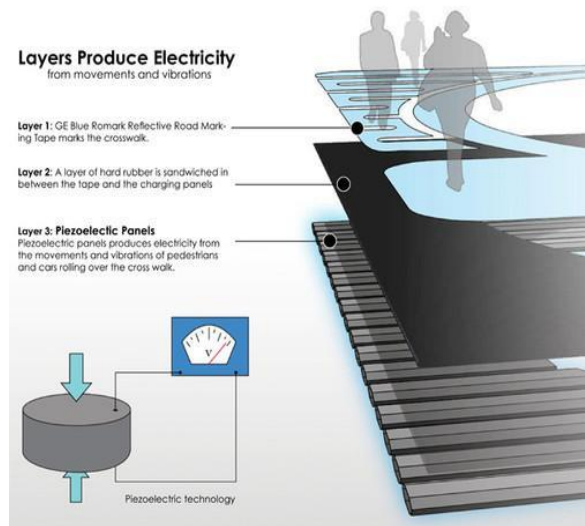


II. PIEZOELECTRIC EFFECT

Piezoelectricity is the property which is shown by certain materials which are known as Piezoelectric Materials. Using this effect electricity can be generated from the piezoelectric materials.

When the pressure is been applied on Piezoelectric Materials there is a tensile stress produced in them. When the pressure is removed from the material there is a compression in the material. The continuous Tension and Compression Cycle causes Electric Current to be produced in them. These current can be obtained in from of electricity by means of Piezoelectric Generators.

This effect could be implied in the places where there is a constant Tension and Compression processes are available. In this paper, we are going to discuss about few ways of generating electricity from piezoelectric materials.

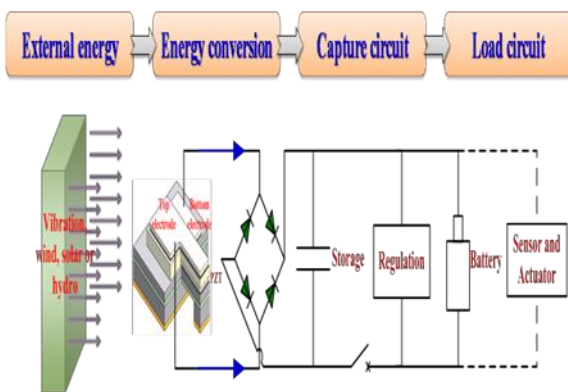


III. PIEZOELECTRIC MATERIALS

There are several Piezoelectric Materials such as Quartz, Topaz, Lithium Neobait, Rochelle Salt etc. We could come to

the conclusion that the materials are very costly, but it is not true. It is true that the materials like Quartz and Topaz are costly, but not the Rochelle Salt. Rochelle Salt Crystals could be produced in laboratory by means of the simple chemicals like Potassium Bitartrate, Sodium Bicarbonate and Distilled Water. Hence the Piezoelectric Materials are not expensive as they seem to be.

Also, after a several research made from several decades, it is found that A Human Bone is also a great Piezoelectric Material. Thus, finding piezoelectric material is not an expensive program which separates it from other Non-Conventional Sources of energy like Nuclear Energy.



IV. APPLICATIONS OF PIEZOELECTRIC EFFECT

There are several applications of the Piezoelectric Effect which are currently in use. These applications are used in day-to-day life. Here are these applications:

1)Clock: A clock is an ideal example of the piezoelectric effect. In a clock, there is application of Reverse Piezoelectric Effect. The Quartz in the clock is powered by Lithium Cell, which provides the electric charge and the vibration is produced in the Quartz and hence the hands of clock is moved.

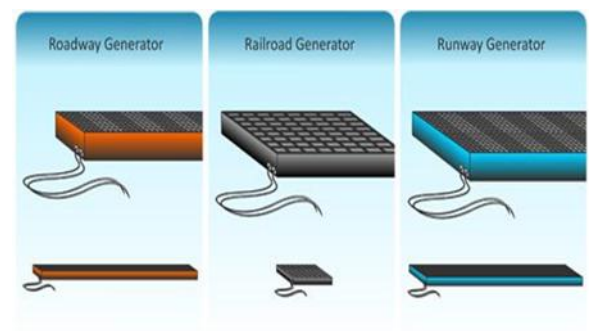
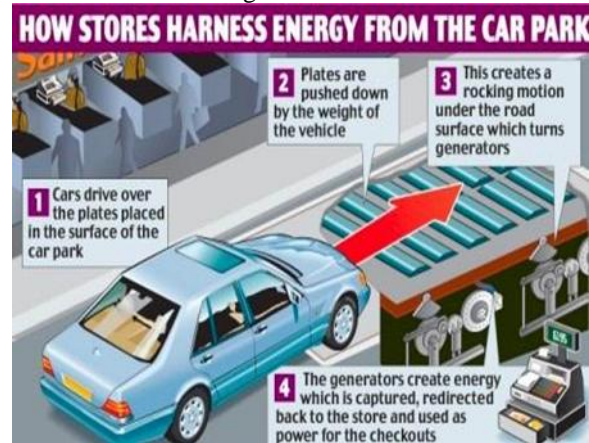
2)Lighter: A Gas or a Cigarette Lighter is another application of Piezoelectric Effect. It is the application of Direct Piezoelectric Effect. In the lighter, the pressure is applied mechanically on the Piezoelectric Material Sheet by means of a Push. Then the current is produced which causes to raise a flame.

Not only this common daily life applications, but there are several other application of Piezoelectricity to generate the electricity. They are:

1)In Japan, near the Tokyo Railway Station, there is a Piezoelectric Material Tile placed on the road near to the station. Daily, many people walk through it to generate electricity.

2)In UAE (United Arab Emirates), there is an experiment conducted to generate electricity from the Piezoelectric Roads. The experiment was successfully conducted and now the practical roads are on the way of construction.

3)In USA (United States of America) in certain schools, electricity is generated from Piezoelectric Tiles in the passage when students walk through them.



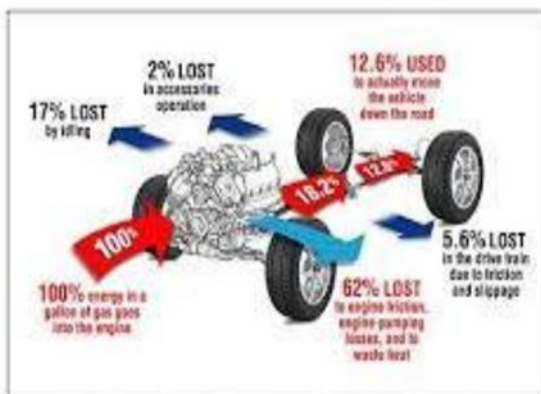
Piezoelectricity From Roads

These images show a little concept about how electricity is generated by means of Piezoelectric Roadway or Runway Generators.

V. PIEZOELECTRIC TYRES

Piezoelectric Tires is a new trend in the Piezoelectric Electric Power Generation. A tire making company Goodyear has invented a concept BH03 Tire and it was unveiled in the

Geneva International Motor Show. The tire is fitted with Thermo-Piezoelectric material which converts the heat into electricity. Also, when the tire rolls on the road it produces electricity from the friction by means of Piezoelectric Effect.



This diagram illustrates the paths of energy through a typical gas-powered vehicle in city driving.

VI. PIEZOELECTRICITY FROM SUBURBAN RAILWAYS

As we all know that the Indian Railway is the world's Second Largest Railway Network. It comprises of a Railway Route of nearly 1,15,000km which is covered by a Railway Track of 65,000km. The Suburban Railways of Mumbai is one of the major stream of the Indian Railways as it serves an average of 50,00,000 people per day.

The suburban railway of Mumbai consists of 4 sub-streams that are Western, Central, Harbour and Trans-Harbour. There are many trains running through this line per day which overall carry 50,00,000 passengers per day. In this paper, we have found the applications of piezoelectricity in the railways.



Piezoelectricity From Railway Tracks:-

The railway tracks on the platform of the railway stations will be replaced by the Piezoelectric Material Ceramics which will be connected with the Piezoelectric Railroad Generators. As the train will pass through this platform there will be a Tension and a Compression simultaneously on the ceramics which will produce Piezoelectric Effect in them resulting in the generation of electricity by the generators.

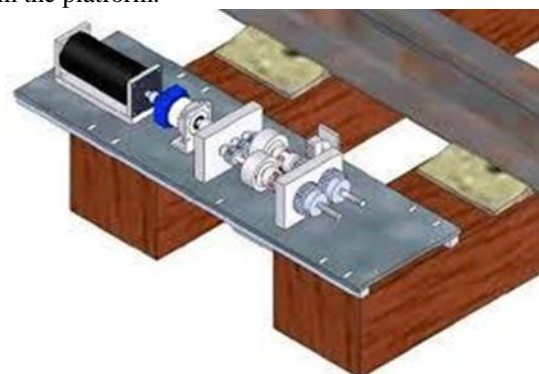
For a normal pressure of 50kg, the electricity generated is 0.01W for the area of 1cm².

Let,

Weight of the Train = 16 Tones

Length of the Track = 100m

Then, the electricity generated from one train on one platform is 1.92MW. This is a very large amount of electricity as it is produced in nearly 1 minute till the passage of train from the platform.



Piezoelectricity From Platforms:-

Platforms of the railway station is also another ideal place to generate electricity from Piezoelectric Materials as a large amount of Tension and Compression process is available on the platforms. If the platforms and the staircases are replaced by piezoelectric materials, then the electricity will be generated from them as the people will walk through them.

Assuming that each person walks about 200 steps on the platform and covering the surface area of 50cm² per step, then the electricity generated by one person is 100W.

When the calculation is raised to the walking of 40,00,000 people travelling through railway per day, then the electricity produced in one day is 400MW per day.

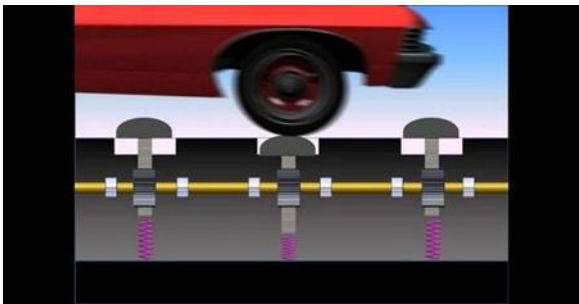
In this way, lot of energy could be generated from the Railway Platform by doing nothing special.

VII. PIEZOELECTRICITY FROM ROADS

Similar to the railways, Piezoelectricity could be also generated from roads by driving the vehicles on the Piezoelectric Roads. For these purpose, the Roadway Generators are been used. This idea could be efficient on bigger and crowded roads where there are large numbers of vehicles running through them.

The roads like Rajiv Gandhi Sea Link, Western Express Highway, Eastern Express Highway, Mumbai-Pune Express Way are the good example of such electricity generation.

A normal car weighing 1 tone which runs for 1km on such roads could generate 100Kw of electricity in its run.



VIII. ADVANTAGES OF PIEZOELECTRICITY

1. Cheap source of electricity generation.
2. Generates a large amount of electricity.
3. Does not require any special kind of power plant or another similar setup.
4. It does not require a large space as a Nuclear Power Plant.

5. It does not create any type of pollution.

6. It does not require any operating system for generation of electricity.

IX. CONCLUSION

From the data and information collected on this project, we came to the conclusion that Piezoelectricity is capable of providing us much more energy than our requirements in a very low cost without causing any type of pollution.

It is that type of Non-Conventional and Renewable source of energy that we are looking for, to fulfill our energy requirements. That's why-

“PIEZOELECTRICITY: Key Way To Alternative Energy”.

X. ACKNOWLEDGEMENT

1. All the information and images sourced from www.google.com
2. Related videos and pictures sourced from www.youtube.com
3. Data transfer was done from www.gmail.com

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