## Piezoelectric Energy Harvesting from Vehicle Wheels

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## Abstract

Due to the exponential growth in the human population, the usage of natural resources has also increased leading to exploitation. Modern civilization requires humans to rely upon fossil fuels for the extraction of energy. Fossil fuels are formed naturally from the remains of dead plants and animals and it is used as fuel and to generate electricity. Since fossil fuels take millions of years to be formed and the available resources are depleting faster than the new ones being formed, they are referred to as non-renewable resources. Another drawback being it contributes largely to the global warming crisis. Fossil fuels produce large quantities of carbon dioxide and other greenhouse gases leading to climate change. Therefore, to minimize the burden and protect the climate, it has become essential to discover different forms of energy harvesting methods. In the recent days, piezoelectric materials are gaining wide popularity because they have potential to provide reliable and cost-efficient substitution to fossil fuels. The paper reviews extraction of electrical energy by inserting piezoelectric materials in the tyre and eventually reducing the usage of fossil fuels.

Index Terms– Energy Harvesting, Piezoelectric Crystals, Piezoelectric Materials, Fossil fuels

INTRODUCTION: The piezoelectric effect converts kinetic energy in the form of vibrations or shocks into electrical energy. Piezoelectric generators (energy harvesters) offer a robust and reliable solution by converting normally wasted vibration energy in the environment to usable electrical energy.

Piezoelectric energy can be harvested to convert walking motion from the human body into electrical power. Recently four proofof-concept Heel Strike Units were developed where each unit is essentially a small electric generator that utilizes piezoelectric elements to convert mechanical motion into electrical power in the form factor of the heel of a boot. The results of the testing and evaluation and the performance of this small electric generator are presented. The modern civilization has caused an excessive amount of burden on natural resources like fossil fuels for harvesting energy. It has adverse effects on the climate and

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human health as well. Hence it is necessary to develop nonconventional methods for harnessing energy. Few of which have been successfully implemented are solar, wind and biogas energy. Recently, a new technology has been developed that uses a piezoelectric material to harvest energy from vehicle wheels. A piezoelectric material is used to convert mechanical stress into electrical voltage. The phenomena of production of electric energy from the force applied on a piezoelectric material is known as piezoelectric effect. Some of the naturally available piezoelectric materials are Rochelle salt and quartz crystals. And unnatural piezoelectric materials include lead zirconate and barium titanate. Piezoelectric crystals when placed between two metal plates and subjected to mechanical force, it causes the electric charges within the crystal out of balance. Excess positive and negative charges appear on the opposite sides of the crystal face. The metal plates collect and use this charge to generate electrical energy. Similarly, we can align the piezoelectric crystals inside tire and produce electric energy from mechanical force. In this review paper, the electrical energy produced is stored in a capacitor or battery for further use. Piezoelectric material produces an AC voltage, it is converted to DC voltage using a rectifier or an inverter. It is converted to DC voltage because all the electrical appliances use DC supply. The piezoelectric material used in this paper is PZT-5A.