Name(s)

Lauren Harris

Project Number

S1012

Project Title

Piezoelectric Energy Generation from Roadways and Pedestrian Walkways: A Practical Field Test of a Piezoelectric Speed B

Abstract

Objectives

The purpose of this project is to capture green energy from the Piezoelectric Effect. This is the ability of piezoelectric materials to generate electricity in response to putting mechanical stress on it. The effect is reversible. It generates electricity when stress is applied but it can also generate stress on the piezo material causing it to deform and vibrate when electricity is applied. It has common uses such as the ignition source for lighters and in producing the speaker sounds from electric guitars. Many piezoelectric energy-generating approaches are done on a small scale, like using piezoelectric shoes to charge personal electronics. However, my project tests a potential way to harvest much larger amounts of energy from road vibrations caused by cars driving over a speed bump or from floor vibrations caused by pedestrian traffic over a floor panel. Many natural materials are piezoelectric such as crystals (quartz, sucrose), bone, enamel, and even DNA. Synthetic materials like ceramics have also been created. I generated naturally occurring Rochelle salt crystals and used a quartz crystal to demonstrate the piezoelectric effect for this project. However, I used synthetic ceramic piezo tiles to build a speed bump and floor panel. I tested the energy generated and stored by my design using different car models and people of different weights and made estimates of energy generation for its use on a typical neighborhood street like my own and if used on the floor of a Metro subway entrance during peak use times.

Methods

Speed Bump Design:

The speed bump is designed with 32 piezoelectric generators wired together in parallel. The piezoelectric generators are mounted onto a black, rubber, cable protector in a line. When tested, the speed bump was hooked up to a multimeter to record amperage and an oscilloscope to record the voltage.

Foot Pad Design:

The foot pad was designed where the piezoelectric generators were set towards the center of the pad. Each generator is secured with a double-sided piece of thin tape on the underside of them. Like the speed bump, when tested, the foot pad was hooked up to a multimeter to record amperage and an oscilloscope to record the voltage

Results

My experiments demonstrate that my piezoelectric speed bump could produce enough power (average 8 kilowatt-hours per day) to power 3 incandescent or 16 LED traffic lights saving $1800-$6000 per year for the city.

Summary Statement

Piezoelectric Energy Generation from Roadways and Pedestrian Walkways

Help Received

I received support from my parents in driving the cars used for my project and buying materials.