CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

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Project Number

J0215

Project Title

The Effect of the Layout of Piezoelectric Crystals on the Amount of Electrical Energy Generated

Abstract

Objectives/Goals

One of the ways to use less fossil fuels is by energy harvesting. Piezoelectric crystals can be used to transform the pressure applied on them into electrical energy, which can then be stored and used to power electronic devices. It is a clean way of power generation which helps to reduce global warming. Piezoelectric crystals are expensive which adds to the overall cost of the project. My experiment is to find an optimal layout where you use fewer crystals to generate the same amount of electrical energy, thereby reducing the cost of any piezoelectric project. My hypothesis is that the piezoelectric crystals when placed in an "S" layout will generate the most electrical energy, when compared to the "V" or "Clustered in the center" layouts.

Methods/Materials

I used cream of tartar, soda ash, and distilled water to make rochelle salt which is a piezoelectric crystal. Other piezoelectric crystals are Topaz and Quartz crystals. I cut up three styrofoam platforms and made small dips in each to hold the piezoelectric crystals. I used eight crystals to assemble each of the three layouts. Using a soldering iron, electrical wires, and aluminum foil, I connected the crystals in series. I attached the probes of a multi meter to the first and last crystals in each layout. I applied pressure by placing heavy books onto the platform and measured the generated electrical energy using a multi meter.

Results

Among the three layouts, the "S" layout generated the most electrical energy (average of 148.8 milli Volts). The "V" and the "Clustered" layouts generated electrical energy with an average of 135.2 milli Volts and 133.4 milli Volts respectively. Hence my hypothesis was supported.

Conclusions/Discussion

The results from my experiment can be used in real-world applications such as placing piezoelectric crystals in the sole of running shoes to charge electronic devices. I have come up with a model of a shoe sole which can be used to store the generated power in a battery pack. The battery pack can then be used to charge electronic devices such as smartphones and tablets. In my model design the crystals are placed in the heel and front part of the shoes where more pressure is felt due to the runner's weight, and the middle part holds the bridge rectifiers and the two battery packs. The battery packs will be removable, and the entire setup must be designed such that it can be transferred easily from one shoe to another.

Summary Statement

My experiment results can be applied to a real-world application such as in running shoes to generate power to charge smartphones, and this helps to reduce global warming.

Help Received

Mrs Pronati Mondal, Science Teacher, Challenger School - Almaden Campus.