CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

Brandon L. Cabatu

Project Number

36065

Project Title

Thermoelectricity: The Direct Conversion of Heat into Electricity Utilizing the Seebeck Effect

Abstract

Objectives/Goals

Based on my research on thermoelectricity, I believed that I would be able to convert heat into electricity by utilizing the process called the Seebeck Effect. The Seebeck Effect was discovered by a physicist known as, Johann Seebeck, and is based upon the production of electricity by using two different conductors, or semiconductors, at two varying temperatures in order to create an electromotive force to drive the charged particles through the materials. I also want to prove that the fundamental equation: V= (SB-SA) (T2-T1) explains how the temperature differences and Seebeck coefficients of the material affect the voltage produced from the basic thermoelectric circuit.

Methods/Materials

I first created a basic frame for the circuit and attached Junctions 1 and 2 together. Then, I continuously changed the temperature of Junction 1 to cold, medium, etc., while keeping Junction 2 under constant room temperature. I did this a total of 5 times per difference in temperature, for each metal combination, and found both the average temperature and voltage associated with the metal combination. Lastly, I used a K-type thermocouple, which I connected to the multimeter, in order to record the flame voltage and convert it into a temperature gradient.

Results

My science experiment on the Seebeck Effect was successful since I was able to produce a voltage from the differences in temperature and the difference in the conductors Seebeck coefficients. The Seebeck coefficients, for the metals, determined the best possible thermocouple, which turned out to be Nickel, -19.5 mV/K, and Zinc, 2.4 mV/K, because of the large difference in each metals Seebeck coefficient.

Conclusions/Discussion

My hypothesis turned out to be correct since I was able to find the best metal combination that produced the greatest voltage, which turned out to be zinc and nickel. The equation: V= (SB-SA) (T2-T1) proved that the larger the difference in the Seebeck coefficient and temperature between the metal combination, the larger the voltage would be. The large difference in the Seebeck coefficient of zinc and nickel verified the voltage equation and proved that the larger the difference in the Seebeck coefficient, the higher the voltage. Ultimately, I was also able to prove that you could convert heat into electricity using the metals: copper, zinc, aluminum, nickel, and utilizing the process of Seebecks Effect.

Summary Statement

My project is about the conversion of heat into electricity by utilizing a physical phenomenon known as the Seebeck Effect.

Help Received

None. I conducted this experiment by myself.