CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
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Project Number
J1305

Project Title
Got Thermal Conductivity?

Abstract

Objectives/Goals
My objective is to explore how some common metals of different thermal conductivities can be used to achieve good thermal management in various applications.

Methods/Materials
I selected copper wires gauges 4, 8, 12 and gauge 18 aluminum, copper, and steel wires. I applied one end of each meter long wire to my heat source to get steady one-dimensional heat conduction. I then measured the temperatures at various distances along the wires' heat paths leading down the wires and to the atmosphere.

Results
Copper exhibited the best heat conduction followed by aluminum and steel. At about 200 mm to 400 mm from the heat source all the temperatures for all the wires remained relatively constant near room temperature. This occurred despite that the thermal conductivity of copper is twice the thermal conductivity of aluminum and 25 times the thermal conductivity of steel. This also occurred despite testing the same material, copper, but with different gauges.

Conclusions/Discussion
Some of the variables that are prominent in heat sinks or cooling devices are their material, surface area, and arrangement. High thermal conductivity is one of the characteristics that make heat sinks efficient. The surface area of the material is also important in cooling electronics. Therefore, I think how a material's surface area, size, shape and thermal conductivity are combined in various ways can be used to help build heat sinks that run more efficiently to achieve good thermal management in electronics

Summary Statement
In my experiment I compared heat flow in wires made of different metals and in different gauges to explore how metals can be used to achieve good thermal management in various electronic applications.

Help Received
I borrowed equipment from a lab and took it home, my parents drove me to various stores to get wires, my dad showed me how to enter data in Excel and make a graph, my science teacher read and commented on my data analysis, and I got useful critiques from Placer County STEM Expo judges including Matt