# Thermoelectric Properties of Materials

Rishi Kodukula, Matt Winert, Renkun Chen

Department of Mechanical & Aerospace Engineering , University of California, San Diego, 9500 Gilman Drive, La Jolla, California

## ABSTRACT

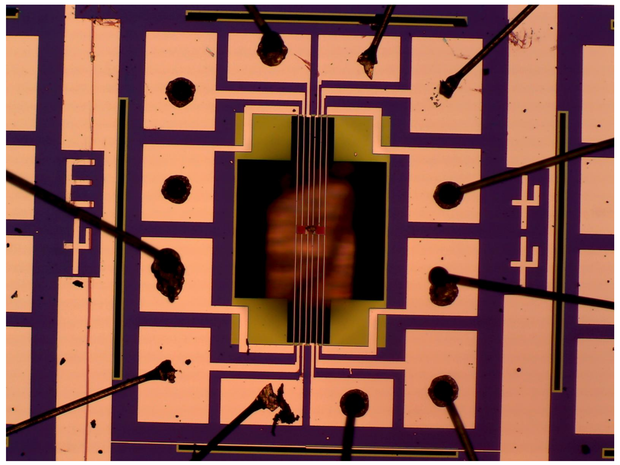
Thermoelectricity is the ideality that one can use natural concepts such as running water or the sun to produce energy. Utilizing our natural world to help us produce the power for our houses and streets. Fossils Fuels are primarily used now a days but it is limited. We can use are environment to enhance our everyday world. We will run out of fossil fuels so we must search for more reliable and abundant power source that will not destroy our serine planet with pollution or hazardous compounds that can destroy delicate ecosystems. Some include the following. Hydroelectric is using running water like in a stream or river to run turbines that generate electricity. Solar energy is the use of our closest and brightest star's light trigger a flow of electrons to be used to power houses and buildings. You could also use wind energy and have the natural wind spin turbines that cause chain of events that will fill a generator and be used to run industries and residents alike. You could also amplify what energy that is coming out using superconductors

## Conductivity of Copper induced by Ultraviolet Light

This is a vary primitive and simple solar panel. It is reflecting the the sunlight off an aluminum plated semicircle concentrated onto the two copper plates sandwich with a device that reads the voltage and temperature that the copper wires are at. Since the angle that the sun changes throughout the day the angle that the semicircle must be placed at different angles for the entire day. The altitude that the contraption is at will play a role on the directness of the sun. There are many factors that must be factored in when one is trying to utilized our closest star for electricity. This could be used to send electricity using most organisms own life sustaining natural light.

The copper plates are inside the tub that is at the middle of the half circle. There is aluminum on the halfcircle so the lighe bounces into the copper rods

## Nano chips and Nanowires



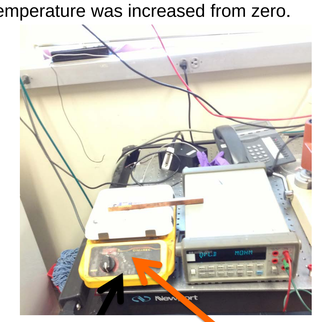
The circuit board at a magnification of 50X. It is part of a group that is about 4 row and 4 columns. This is where we must aim the little needle before we went to the next magnification showed bellow.

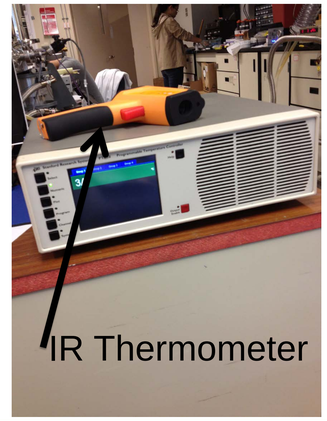
This is the next magnification at a magnification of 200X. This is the two wires and there is the bundle of wires that are making a bridge between the two suspended wires. One must use great precision to place this Geranium Telluride wires on the circuit board and leave the area without bumping into anything or breaking the wires on the circuit board.

Using a stick about 10 nanometers long one could pick up these little wires and place them on chips with Geranium Telluride wires. I controlled the wire with three knobs that moves the needle on x axis, y axis, and z axis. The movements are very small and visible under the microscope. First I would get some nanowires from a metal and get some wires on the needle then I must maneuver around a circuit board and be above the two small wires on the circuit board. Then I must use the knobs to place the nanowires on the circuit so it is like a bridge so the current can flow between the resistors. Then I must move the wire out without braking the bridge that I just made.

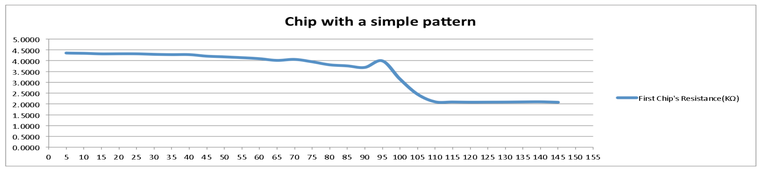
## Temperature Verse Resistance

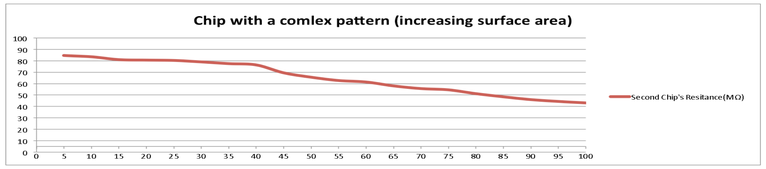
These copper wires are very good conductors of electricity. Copper is a vary ductile and malleable element making it easy to be made into wires and rods. Copper is the second best conductor only to be surpassed by silver as understood by the current periodic table. When any metal heats up it releases energy since the circumstances are just right for this release. One can measure the resistance that a material has to see if that kind of wire can transfer and store energy across a sample. I studied the resistance that two chips encountered as the temperature was increased from zero.




## Graphs of the temperature vs. Resistance




The graphs might look the same but there are different units making the chip with the more complex design have a higher resistance than one with a simple design. This tells that the area plays a role in the change in resistance as the temperature steadily increases. This has to do with the formula $R=\rho L/A$. $\rho$ is a constant for all chips so the resistance is equal to length over area. Area is broken down into width times depth. The width is easy to find but the depth is the number that is changing.

## CONCLUSIONS AND FUTURE DIRECTIONS

- One could build of and build machines that track the suns motion throughout the sky so at any time of day the power intake is always significant and not best at one point in time. This kind of programing and position can change the amount of energy that we can accumulate in a given year.
- With the nanowires there is a lot of information that must be understood and testing to find out what combinations that one must use to make the nanowires. Also it could help if the placement was automated because of human error and what we see in the Nano scale world. Nano materials will help make better conductors with more efficiency.
- Many people have found the correlation between temperature and resistance. I have just recreated their experiments with different compounds. I helped prove what has already existes with new substances. I think one could build these circuits and they would be able to function at such high temperatures needed to power machines.