

Light Bulbs

Which filament keeps the bulb
burning for the longest time?

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Abstract

I read a book about Edison where he tested different filaments to create a light bulb so *I* wanted to do the same. With my father's help I created a homemade light bulb to test different filaments: hair, wood, copper, iron, carbon, and nichrome. I hypothesized that using multiple strands of iron wire will be ideal for burning a light bulb but my hypothesis was proved wrong. Since nichrome glowed the best, I tried to make a vacuum with a candle to see if it would make a difference. It glowed much longer, so nichrome filament with the vacuum was the best light bulb I could make.

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Questions, Variables, and Hypothesis

Question:

Which filament keeps the bulb burning for the longest time?

Further questions that originated during the experiment:

Which thickness of filaments is ideal for a burning light bulb?

Will a vacuum make a difference?

Variables:

Number of strands of filaments, vacuum, type of filaments

Hypothesis:

I hypothesized that using multiple strands of iron wire will be ideal for burning a light bulb.

Background Research

What is a light bulb?

A light bulb is a source of light that lights by passing electric current through a thin filament enclosed in a transparent glass bulb with a vacuum.

History of a light bulb:

Thomas Alva Edison invented light bulb in 1879. He tried hundreds of times to make filaments that would glow and not burn up. He used many different materials, from cardboard to bamboo. Edison was persistent -- he never gave up trying until his project worked. On October 21st, 1879, Thomas Edison kneaded sewing thread that was made of cotton in a finely ground kind of soot called lampblack. He baked it and then mounted it onto a vacuum bulb. It glowed for a day and a night {approximately 34 hours}.

Materials List

- 1) Insulated copper wire with alligator clips attached to both ends
- 2) Wire cutters
- 3) Wire strippers
- 4) Glass jar
- 5) Candle and Matches
- 6) Electric tape
- 7) 6-volt battery
- 8) Stopwatch or watch with a second hand
- 9) Different kinds of filaments:
 - a) Hair
 - b) Copper
 - c) Wood
 - d) Iron
 - e) Carbon
 - f) Nichrome

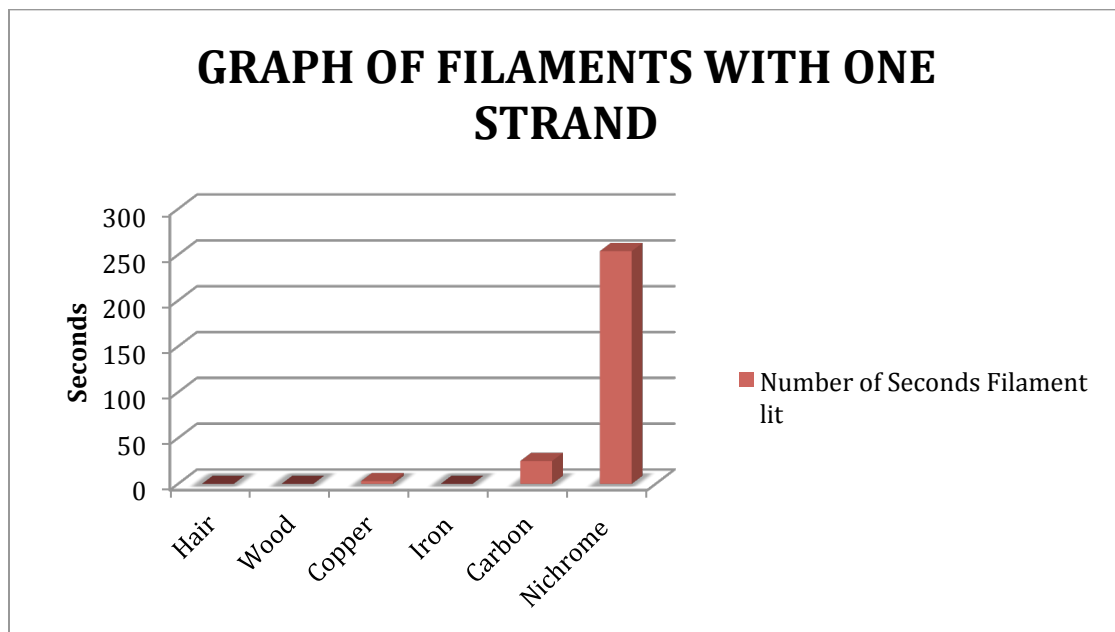
Experimental Procedure

- I got a cardboard box for a base and attached a small piece of Styrofoam to the cardboard base.
- Then I attached one of the free ends of the first wire with the alligator clip to the positive terminal of the battery and other end with the alligator clip was taped to the Styrofoam.
- After that, I attached one of the free ends of the second wire with the alligator clip to the negative terminal of the battery and other end with the alligator clip was taped to the Styrofoam.
- I placed the test filament carefully between the two alligator clips attached to the Styrofoam and covered it with a jar.
- Immediately I started my stopwatch and recorded my observations on what happened to the filament.
- I waited for a few minutes for the filament to cool, and then removed it from the light bulb.
- I repeated this experiment using a new filament made from more strands of wire and also other kinds of filaments.
- I recorded my observations: Did the filament burn or glow? How long was it lit for?

Data Analysis

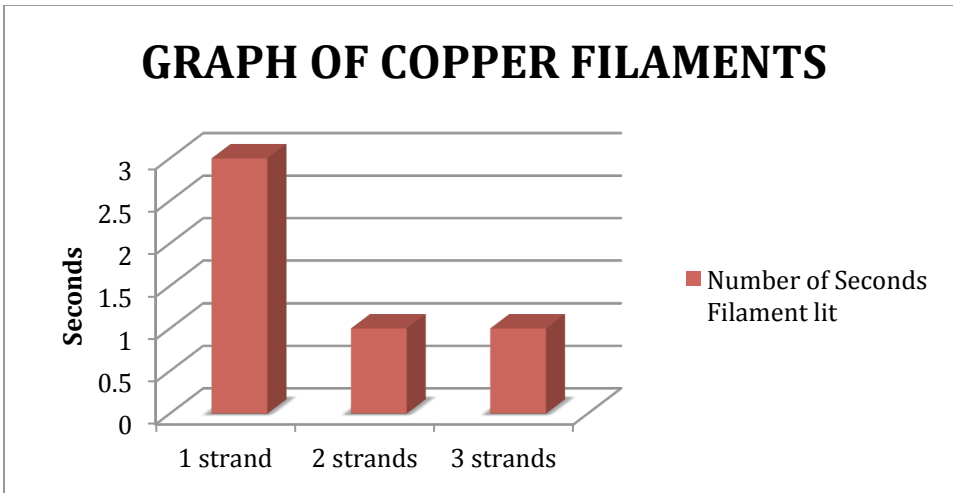
Without Vacuum

Type of Filament	Number of Strands	Number of Seconds Filament lit	Burn or Glow?
Hair	1	0	None
Wood	1	0	None
Copper	1	3	Burn
Copper	2	1	Burn
Copper	3	1	Burn
Iron	1	0	None
Carbon	1	25	Glow
Nichrome	1	254	Glow
Nichrome	2	15	Glow
Nichrome	3	5	Glow



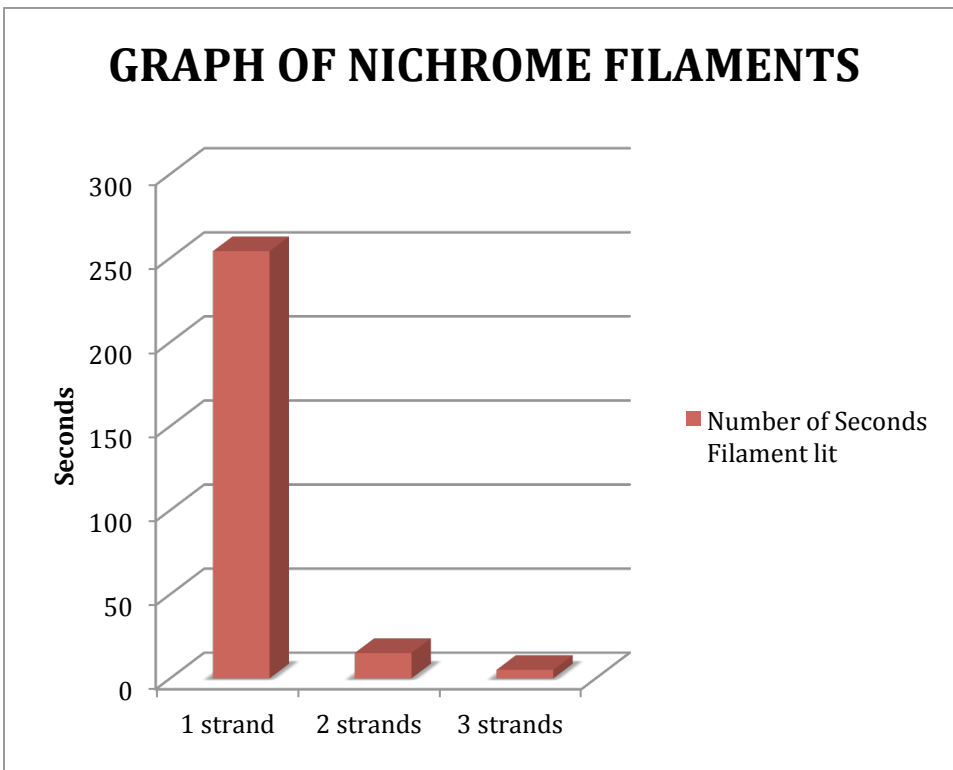
Graph Analysis:

This graph shows that nichrome worked the best and carbon also worked. Copper gave glowed for three seconds. Hair, iron, and wood did not work at all.



Graph Analysis:

This graph shows that copper with one strands lasted three second. Copper with two and three strands lasted only one second.

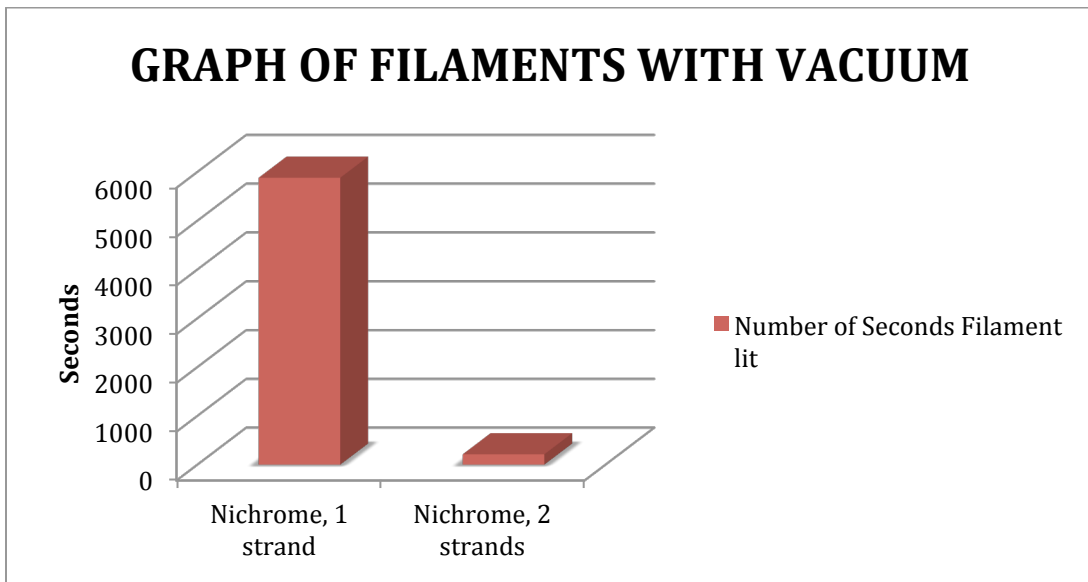


Graph Analysis:

This graph shows that nichrome with three strands worked for five seconds then two strands lit 15 seconds and one strand lit for 254 seconds.

With Vacuum

Type of Filament	Number of Strands	Number of Seconds Filament lit	Burn or Glow?
Nichrome	1	5880	Glow
Nichrome	2	211	Glow



Graph Analysis:

This graph shows that nichrome with the vacuum with one strand lit for 5,880 seconds and nichrome with vacuum with two strands lasted 211 seconds.

Conclusion

Nichrome filament glowed the longest and brightest. So I chose Nichrome to test if the vacuum will make any difference. I found out that vacuum made the filaments glow longer and brighter. The reason could be: A light bulb contains a thin filament that glows hot when an electric current is run through it. In the presence of oxygen, the filament burns up as a result of the high temperature. When a glass jar with a candle was used to keep oxygen away from the filament, the filament glowed brighter and longer.

Effect of Thickness {Number of Filaments}

Thin filament {one filament} burns longer and brighter than thick filament {multiple filaments}. The reason could be: a thin filament has a fewer number of electrons to carry the current. As a result the thin filament heats up more and lights up better.

Based on my results above, my hypothesis was incorrect.

In my experiment, a single strand of Nichrome filament lit up the longest and brightest. With the addition of the vacuum it lit up even longer and brighter.

Acknowledgements

I would like to thank all the people that helped me with this project. My parents were with me at all times during this project and never hesitated to tell me what I was doing wrong or what I might want to add. I thank my brother for helping me with the charts on MS Excel.

References

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