



**CALIFORNIA STATE SCIENCE FAIR  
2011 PROJECT SUMMARY**

<b>Name(s)</b> <b>Max J. Eisenstadt</b>	<b>Project Number</b> <b>J1305</b>
<b>Project Title</b> <b>Cutting Edge</b>	
<b>Objectives/Goals</b> Why does a nichrome wire get hotter than other wires? My hypothesis is that the elements in a nickel-chromium alloy wire must be more resistant to the flow of electricity and become heated more quickly. The purpose of this experiment is to identify and test some of the factors of wire resistance and the electrical laws that apply to them. This project was based on an actual incident using a craft wire in a foam cutter instead of a nichrome wire.	
<b>Abstract</b> <b>Methods/Materials</b> 32-gauge wire: nichrome, stainless steel, copper screwed to wooden block Digital multimeter; Foam cutter and Styrofoam; D-cell and 6 volt battery  1. I tested 3 types of 32-gauge wire: nichrome, stainless steel and copper for their resistance with multimeter. 2. I tested the 10" wire temperature with an electric current running through a 6-volt circuit. 3. I tested the three wires in a 3" foam cutter using a 3-volt battery, measuring the cutting ability and the temperature.	
<b>Results</b> The results from the resistance test were expected: NiCr had the highest average at 8.4 ohms, stainless and copper less than 1 ohm. Unexpected results from the temperature test: the stainless had the highest average at 198 degrees F and NiCr only 142 degrees. The results of the cutting/temperature test were expected: NiCr reached average of 218 degrees, stainless reached 168 degrees, but only the nichrome cut foam.	
<b>Conclusions/Discussion</b> The temperature test showed an anomaly when the nichrome didn't reach a high temperature, so I researched for reasons why that test failed. I believe the nichrome wire was damaged in the pre-equipment check by getting it red hot. I discovered that heat will start to oxidize metal and it will change the wire properties. Additionally, I learned that small diameter nichrome wire is used as ignition fuse because a low voltage will vaporize the wire. That was the key. I applied Ohm's Law ( $\text{amps} = \text{volts} / \text{resistance}$ ) to my resistance data. My hypothesis was correct. Less amperage was needed to provide usable heat because of the high resistance. NiCr needed only 0.9 amps to turn electrical energy into heat energy; compared to 12.5 amps for stainless steel. Knowing how resistance affects different materials is helpful if you're working on a project that requires electricity.	
<b>Summary Statement</b> The purpose of this experiment is to determine why resistance causes a nichrome (nickel/chromium alloy) wire to get hotter than wires of different compositions when a current of electricity is applied.	
<b>Help Received</b> My Father supervised the temperature test after pre-test equipment check had red-hot wires. My Mother encouraged me to do more research after experiment failure and proof-read reports.	