



**CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY**

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| Name(s) Joanna Estrada; Stephen Hop; Craig Imazumi | Project Number S1504 |
| Project Title Seebeck Effect: The Thermoelectrical Potential of Various Metal Couples | |
| <p style="text-align: center;">Abstract</p> <p>Objectives/Goals The Seebeck effect is the generation of electrical potential when strips of two dissimilar metals are connected to each other, where the two junctions of the metals are at different temperature. In this experiment, the potential was measured when nickel, tungsten, copper, silver, and Alumel (5% Al, 95% Ni) are paired with Chromel (10% Cr, 90% Ni) and steel at 0 and 100 deg C. It is hypothesized that metals with the largest difference in ionization energy between the metal and Chromel or steel will generate the largest potentials. Because nickel has the lowest ionization energy of the metals we measured, we expect it to generate the largest number of microvolts, and therefore to be the best thermocouple material.</p> <p>Methods/Materials The thermocouples were submerged in boiling water and ice water, and the resulting voltage was measured using a voltmeter. (Actually, a Fluke 87 Multimeter and a Fluke 80TK Thermocouple Module was used to read the #temperature# in degrees C, which we converted to voltage.)</p> <p>Results The results demonstrate that Nickel wire coupled with Chromel generated the largest potential, followed by Alumel, silver, copper, and finally tungsten.</p> <p>Conclusions/Discussion In thermoelectrics there is something called a Seebeck Coefficient. The Seebeck Coefficient is the thermoelectric sensitivity of each metal. Ionization energies are directly linked with Seebeck Coefficients. The larger the difference between the Seebeck Coefficients of the paired metals, the higher the voltage. Our results are consistent with what is predicted by Seebeck's theory.</p> | |
| Summary Statement Finding the best metal to create a voltage when paired with either steel or chromel in a thermocouple. | |
| Help Received Jack Parsels helped with wires and concepts. Keiko Imazumi helped with board layout. Stan Aochi helped with concepts. | |