



**CALIFORNIA STATE SCIENCE FAIR  
2004 PROJECT SUMMARY**

<b>Name(s)</b> Flavia I. de la Fuente	<b>Project Number</b> <b>S0205</b>
<b>Project Title</b> <b>Do Different Types of Metal Alloys Vary in Their Resistance to Elevated Heat when Measuring Hardness?</b>	
<b>Objectives/Goals</b> The purpose of this project was to determine which types of metal alloys resisted elevated temperatures the most effectively when measuring hardness.	
<b>Abstract</b> <b>Methods/Materials</b> Materials :Rockwell Hardness Tester 3 samples of 4130 iron-based alloy about 700 grams each 3 samples of titanium-based alloy (6% aluminum, 4% vanadium) about 700 grams each 3 samples of Unitemp 718 nickel based alloy about 700 grams each High Temperature Oven Sandpaper Procedure 1. Take the nine samples of metal alloys and mark their Rockwell Hardness on the #C# scale 2. Put nine samples in oven for 4 hours at 300 degrees Fahrenheit. 3. Let samples cool inside oven overnight (oven runs for four hours and then automatically shuts off) 4. Take samples and remove any oxidation by rubbing against sandpaper 5. remove samples and measure Rockwell Hardness 6. Take nine samples and repeat steps 2-5 at 600 degrees, then in increasing increments of 300 degrees until 1500 degrees	
<b>Results</b> The results indicated that the metal alloys all increased in hardness until they reached a peaking point, after which their hardness began to drop. The three alloys, as a whole, grew in hardness until they reached the vicinity of 1200 and 1500 degrees, where they started to drop sharply. If further tests with higher heat exposure were conducted, it is most probable that the hardness level would continue to decrease. The Steel alloy held a somewhat consistent hardness level until it was exposed to 1200 degrees, the temperature at which the hardness level dropped by about 5 units. The steel alloy also kept oxidizing, and the oxidation had to be rubbed off with sandpaper every time in order to measure the hardness. The titanium alloy was consistent in its hardness yet began to increase sharply in hardness at 900 and 1200 degrees. It then peaked and dropped severely at 1500 degrees. The nickel alloy grew steadily in hardness until it reached 1500 degrees and dropped off sharply.	
<b>Conclusions/Discussion</b> In conclusion, the nickel-based alloy Unitemp 718 should be used in the aerospace industry where high temperature resistance is necessary- however, it is only applicable where the highest temperature does not exceed 1200 degrees Fahrenheit. Steel should definitely not be used in an environment with elevated temperatures, because the heat is basically burning away at the metal, continually decreasing its size.	
<b>Summary Statement</b> My project is about the ability of industrial metals to withstand elevated temperatures when measuring hardness.	
<b>Help Received</b> My dad provided equipment.	