



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Nishitha Viswanathan	Project Number S0226
Project Title The Effectiveness of Surface Passivation Coatings on Copper	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Copper is utilized as a medium for conducting electricity in electronic devices. However, when any of these components come into contact with moisture, the electron flow is halted, thus ending the life of your device. To prevent this, companies have developed coatings to repel water from the copper surface. Water repulsion is characterized by the contact angle of a droplet formed between the solid/liquid interface: Hydrophilic: 0°-89° Hydrophobic: 90°-149° Super-hydrophobic: Greater than 150° Hypothesis: If each sample is immersed in tap water for a period of 24 hours, there will be a decrease in the contact angle measurement due to the deteriorating quality of the coating.</p> <p>Methods/Materials The coatings tested include Repellix, Organic Solderability Preservative, and gold with a nickel vanadium barrier. Using a homemade measurement system, a single drop of deionized water was placed onto a sample and an image was acquired using a microscope camera. The contact angles were measured using the software. The samples were placed in tap water for 24 hours and measured again. After the immersion, the contact angle had increased, thus contradicting my hypothesis. However, through research, I was able to determine this was due to ionic contamination from the tap water. It was necessary to repeat this procedure in an autoclave chamber for 5 hours with pressure set to 20 pounds per square inch, 100% relative humidity, and 123° Celsius with deionized water.</p> <p>Results After the autoclave test, the measurements were obtained and the results were compared against uncoated copper whose angle had slightly increased. This change depicts the surface underwent change and was unstable. OSP had decreased in its contact angle, thus displaying its gradual decrease in quality. Repellix had not showed any signs of a decreasing contact angle however, it did show signs of discoloration due to the fact that it's an organic nano-coating and will change over time. Gold, however, did not undergo any changes of color or contact angle, thus showing that it's very effective.</p> <p>Conclusions/Discussion The final outcome is not completely contradictory to my hypothesis. It's true that the contact angles had changed significantly but due to ionic contamination from the tap water. However, it's true that as quality decreases, contact angles will decrease also, as confirmed by the autoclave test.</p>	
Summary Statement The objective of my project is to test the quality of various coatings used to prevent copper oxidation based on how well water is repelled from their surface.	
Help Received My dad helped me set up my apparatus, obtain samples, and place the samples in an autoclave chamber [located in the Skyworks Solutions Inc. facility]. In addition, he and my mom provided me with guidance and supervision throughout my project.	