



**CALIFORNIA STATE SCIENCE FAIR  
2009 PROJECT SUMMARY**

<b>Name(s)</b> <b>Aurora L. Ostrom</b>	<b>Project Number</b> <b>S0517</b>
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**Project Title**  
**Deposition of Metal Coatings on Nanoparticles in an Ionic Liquid**

**Abstract**

**Objectives/Goals**  
The purpose of this project is to coat nanoparticles of silver, zinc, tin, and iron oxide with copper (from copper nitrate) and nickel (from nickel nitrate) in the presence of an ionic liquid. Ionic liquids have previously been used to synthesize nanoparticles, but they have not been used to coat them. It is hypothesized that this should be possible since the nanoparticles would provide a site for depositing the metal, which is expected to be more favorable than generating nanoparticles of copper or nickel.

**Methods/Materials**  
In this experiment, microwave heating of copper nitrate and then nickel nitrate dissolved in 1-butyl-3-methylimidazolium tetrafluoroborate in the presence of nanoparticles was performed in an effort to coat copper and nickel onto each different metal nanoparticle. UV-Visible spectrophotometry was used to analyze the solutions before and after heating. Coating formation would be identified by changes in the spectrum of the nanoparticles suspended in the ionic liquid after heating. For comparison, additional spectra were collected from the ionic liquid, copper nitrate, nickel nitrate, and each of the metal nanoparticles.

**Results**  
Spectra collected from test solutions before heating were compared with those taken after heating. Post-heating spectra show the formation of a new absorption peak that did not come from the ionic liquid, the copper nitrate, nickel nitrate, or the metal nanoparticle added. Photographs taken before and after heating also document this change.

**Conclusions/Discussion**  
The new absorption peak present in the spectra collected after heating is attributed to the deposition of copper (in the case of copper nitrate experiments) and nickel (in the case of nickel nitrate experiments) onto the nanoparticles present in solution. These results support my hypothesis that it is possible to deposit metal coatings on nanoparticles using an ionic liquid.

**Summary Statement**  
This project attempts to coat different metal nanoparticles with copper and nickel using an ionic liquid and analyze the results spectrophotometrically.

**Help Received**  
I used chemicals and lab equipment at the Naval Air Warfare Center (China Lake), where Dr. Andrew Guenther was the qualified scientist. My father completed the application and supervised experiments.