



**CALIFORNIA STATE SCIENCE FAIR  
2005 PROJECT SUMMARY**

|  |                                       |
|--|---------------------------------------|
| <b>Name(s)</b><br><b>Alex Hunter; Chas Rowland; Vincent Xiong</b>  | <b>Project Number</b><br><b>J1111</b> |
| <b>Project Title</b><br><b>Can Homeland Security Benefit from the Use of Heat and Light Sensitive Inks?</b>  |                                       |
| <p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b><br/>The purpose of our project was to determine if Homeland Security could benefit from the use of heat and light sensitive inks.</p> <p><b>Methods/Materials</b><br/>We conducted research to find inks that could be used to enhance security. Three types of ink were studied for our project: ultraviolet (UV) sensitive inks, thermochromic inks, and photochromic inks. We tested:<br/># the visibility of a UV ink under different lighting conditions using a photo light meter.<br/># the temperature range needed to change the color of our thermochromic ink.<br/># what types of light activated our photochromic ink.<br/>We each made a security badges using these inks and a duplicate badge made with non-activating inks. We surveyed 30 people to see if they could recognize any differences between the two different badges under indoor lighting, handling (heat), outdoor lighting (UV), and using black light.<br/>We conducted research to determine if these inks are already being used in National Security. Experts in the field were interviewed to determine current security uses of these inks. These experts included: an FBI agent, a California Highway Patrol officer, and personnel from State Airport Security and the California DMV. Questions were also asked of the U.S. Government: Office of Homeland Security, State Department, and Treasury Department.</p> <p><b>Results</b><br/>The thermochromic ink can be activated with body heat. Our photochromic ink can be activated with UV and black lighting. UV sensitive inks become visible only under black light. Out of thirty people surveyed, 80% recognized the activated thermochromic ink, 97% recognized the activated photochromic ink, and 100% recognized the activated UV ink. Our research indicated there is only limited security uses of these inks already in place. Only UV ink is being used by businesses and the U.S. government in the making of credit cards, currency, and driver's licenses. Based on our research, Homeland Security is currently not using any of the ink technologies we have tested.</p> <p><b>Conclusions/Discussion</b><br/>Thermochromic, photochromic, and UV sensitive inks have properties that make the ink easily identifiable upon activation, yet could be difficult to duplicate by counterfeiters. It is our recommendation that Homeland Security should use thermochromic, photochromic, and UV sensitive inks in furthering the security of our nation.</p> |                                       |
| <b>Summary Statement</b><br>We researched and tested thermochromic ink, photochromic ink, and ultraviolet (UV) sensitive ink to see if they could be used by the Office of Homeland Security to enhance our nation's security measures.  |                                       |
| <b>Help Received</b><br>Parents helped with typing, project board assembly, and transportation. Advisor helped with experimental design, accumulating materials, supervision and safety, providing science classroom resources, and research materials.  |                                       |