



**CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY**

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| Name(s) Nicholas Mandala; Theresa Prata | Project Number J1416 |
| Project Title Thermochromic Energy Efficient Roofs: An Innovative Coating that is Solar Reflective when Hot and Solar Absorbent when C | |
| <p style="text-align: center;">Abstract</p> <p>Objectives/Goals To create an energy efficient roof which gives the benefits of a white roof during the hot summer months without compromising the benefits of a dark roof during the cold months</p> <p>Methods/Materials We created a roofing slurry by mixing black thermochromic crystals into a UV protective clear, waterproof, and durable paint base and then applied that mixture onto white roofing materials such as asphalt and metal. Our slurry has the ability to change to clear at the temperature of 90° F thus revealing the white substrate. We built 4 model homes, one with an untreated asphalt roof and one with a treated asphalt roof. We did the same for our metal roof models. We tested our product in a temperature-controlled box that contained two heat lamps, provided by Ryan Hickman. As the ambient temperature increased, we compared the interior attic space, the living space, as well as the roof surface temperatures between our models treated with our thermochromic slurry and those untreated. We ran each test for 30 minutes and repeated it multiple times.</p> <p>Results After running a series of tests our data consistently concluded with zero deviation that our color changing roofing material would reduce the interior attic temperature up to 30°F and the interior space below the attic an average 6°F cooler. The surface temperature difference for the asphalt treated and untreated roofs were up to 41°F and the metal roofs were a huge 81°F temperature difference.</p> <p>Conclusions/Discussion The performance of our thermochromic-slurry treated roofs proved to be significantly more energy efficient than the traditional asphalt and metal roofs thus lowering energy cost and carbon emissions from A/C use. Because of this, we believe that our slurry is a smart solution to help reduce global warming and the rising concern of Urban Heat Island Effect.</p> | |
| Summary Statement We engineered a roofing slurry that has color changing capabilities to provide the benefits of a white roof when it is hot and a dark roof when it is cold. | |
| Help Received We had Ryan Hickman build a temperature control box to our specifications. Ryan Hickman is the Uncle to Theresa Prata | |