



**CALIFORNIA STATE SCIENCE FAIR  
2012 PROJECT SUMMARY**

<b>Name(s)</b> Debnil A. Sur	<b>Project Number</b> <b>S1815</b>
<b>Project Title</b> <b>The Effect of Titanium Dioxide on Photovoltaic Cells</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> This experiment tests the effect of varying concentrations of titanium dioxide (TiO<sub>2</sub>) on the efficiency of photovoltaic solar cells. Though this chemical has shown to improve the efficiency of dye-based solar cells, it hasn't been tested in the context of photovoltaic cells. Three variables will be tested: coating thickness, different types of light, and angle of light.</p> <p><b>Methods/Materials</b> Six PV cells, solid TiO<sub>2</sub>, distilled water, and various light sources were used. Five concentrations of TiO<sub>2</sub> were mixed; after initial measurements of output, cells were painted with different concentrations. They were then tested under different light sources and with varying angles. After washing off the cells, the output was again recorded under the different light sources. Three tests will be done to reduce variability, and data will be standardized by control values.</p> <p><b>Results</b> TiO<sub>2</sub> significantly boosted cell output across the light sources, posting increases as high as 39% in sunlight and 25% in UV; thus, efficiency was improved over the majority of usable light. While an optimal concentration was indeterminate, on the whole, higher concentrations of TiO<sub>2</sub> led to better output; 1 mg/mL seemed to have the most consistent results, though. However, the data collected did not display any clear relationship between TiO<sub>2</sub> and output at different angles, so that effect is indeterminate.</p> <p><b>Conclusions/Discussion</b> Titanium dioxide clearly had a beneficial effect on photovoltaic cell output; at the same time, though, a few additional experiments need to be conducted for larger success. First, more testing should be done to determine TiO<sub>2</sub>'s effect on different angles. Additionally, an optimum concentration should be determined through more detailed testing. Finally, long-term tests should be done of output to determine whether TiO<sub>2</sub> has a corrosive effect. Through these additional tests, hopefully, TiO<sub>2</sub> can be used on a larger scale; these experiments clearly demonstrate that it could have enormous implications for photovoltaic cells.</p>	
<b>Summary Statement</b> I tested the effect of a titanium dioxide coating on photovoltaic cell output, varying coating thickness, type of light, and angle of light.	
<b>Help Received</b> Dr. Youssef Ishmail supervised lab equipment use; my family constantly supported me and helped with my board	