

Optimizing Solar Energy Using CuInS₂ and TiO₂ Nanoparticles

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Solar energy is needed to enhance and sustain the world's energy needs-both now and in the future. Previous research has shown that CuInS₂ quantum dots, miniscule semiconducting nanocrystals, have shown a significant increase in solar cell power, while being cost-effective and safer for the environment. TiO₂ nanoparticles act as doping agent for silicon, which allow multiple excitons to be produced in solar cells, thereby increasing efficiency (Ricci, 2010). The research hypothesis is if CuInS₂ and TiO₂ nanoparticles are applied to the solar cell for 4 hours, then there will be a significant increase in power from the control. The engineering goal is to optimize solar cell power while creating a cost-effective and sustainable solar panel. This project involves testing the CuInS₂ quantum dots across different heat synthesis periods (1, 2, and 4 hours) to alter the crystal size. The solar cells were also tested over days, and the quantum dots prove to be a sustainable design. The addition of TiO₂ nanoparticles adds a notable increase in power. The CuInS₂ 1 hour trials with TiO₂ had the highest power output, with a 138% increase in power and a 48% Efficiency. The CuInS₂ and TiO₂ are also a cost-effective design, saving almost \$1000 difference in price when compared to commercial solar cells in today's market. With the large percent increase in power output, only around half of the solar panels are needed for an average home when using CuInS₂ & TiO₂ application.