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.