Fabrication of Light Responsive Super Capacitor for Energy Harvesting & Energy Storage Applications

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Earth absorbs approximately 3850 zeta joules of solar energy year-1, which is more than enough to power the entire planet. Solar cell technologies have the potential to harvest this energy; however solar cells themselves cannot stock it, so additional storage devices need to be integrated. This method is expensive and risks evaporating the energy into wasted heat in the process. The purpose of this project is to fabricate a single device that can perform the two tasks of harvesting energy from sunlight and storing it as electrical signals using the novel Pulsed Laser Ablation in Liquid (PLAL) method. For the testing, transparent FTO glass slides were used so that the light can reach the active material. Nano-sized titanium dioxide (TiO2) and polyaniline were used as active materials. TiO2 is a well-known semiconducting material for solar applications. Polyaniline is a conducting polymer that shows photovoltaic effect under light illumination. The addition of polyaniline to TiO2 reduced the band gap of TiO2 from 3.15 eV to 2.7 eV, making it more effective under the visible light spectrum. The specific capacitance from the cyclic voltammetry curve came out to be 0.2 F/g, which is reasonable as an initial result. Further optimization is expected to improve this result. This device can charge itself under light illumination without any external electric source. Such a device has great potential to be used in future electronics, such as hybrid vehicles, electric cranes, electronic circuits and wearable devices.

Awards Won:

Fourth Award of $500

Raytheon Technologies Corporation: Each winning project will receive $3,000 in shares of UTC common stock.