A Comparative Study of Electrochemical Solar Supercapacitor Using Cadmium Sulfide Nanospheres and Self Synthesized Quantum Dots by Applying Advanced PLAL Method

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The demands for energy in modern civilization are greater than ever because of the recent developments in electronic technologies. The efficiency of energy conversion and energy storage units has become a critical issue because of the depleting resources of fossil fuels and the environmental problems related with burning of such fuels. To solve these problems, we need a renewable, environmentally friendly, and low-cost resource of energy. The sun is the most reliable source of energy with no harmful impact on the environment. Solar cells are devices that convert sunlight to electrical energy and a supercapacitor is a device that can store this energy. In this work, a photo responsive supercapacitor is fabricated for the purpose of harvesting sunlight like a solar cell and storing it at the same time like a supercapacitor. The supercapacitor device was fabricated using cadmium sulfide (CdS) nanospheres and CdS quantum dots, synthesized using a novel method of pulsed laser ablation in liquid (PLAL). The optical absorption for nanosphere and quantum dots was measured using UV-Vis spectrophotometry and data was used to draw Tauc's plot. The band gap energy for nanospheres and quantum dots was estimated to be 2.31eV and 5.0eV respectively. The size of the nanospheres and quantum dots was estimated to be ~50 nm and ~10 nm respectively using FESEM and TEM. The specific capacitance of the fabricated supercapacitor was calculated to be 5 F g-1 using cyclic voltammetry (CV). This innovation has potential future implications to be applied on various electrical devices.

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