Fabrication of Self-charging Supercapacitor Using LASER-assisted Self-synthesized Carbon Quantum Dots

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In recent years, significant developments in science and technology have occurred, thereby placing a strain on energy demands and supply units. Therefore, there is a need to adopt renewable and environmentally friendly sources of energy, using capacitors and supercapacitors. Usage of toxic materials in such fabrications has led to environmental pollution via the presence of toxic metal ions in water. Introducing light-responsive supercapacitors to this field has made it more renewable. The aim of this research is to fabricate a single device that can perform both harvesting solar energy and storing it as electrical signals simultaneously. This incorporated environmentally friendly material with the novel use of carbon quantum dots in light-responsive supercapacitors. Nano-sized TiO2 and carbon quantum dots were used as an active material because both materials are non-toxic and cheap. A facile method of pulsed laser ablation in the liquid was used to synthesize quantum dots of carbon with a size of less than 10 nm. Quantum dots were adsorbed on the surface of TiO2 film to enhance the light absorption and electrochemical properties of the composite. The specific capacitance from the cyclic voltammetry curve came out to be 10 F g-1, which is encouraging as an initial result. This device can charge itself under light illumination, which is unique. When the light is ON, the supercapacitor charges itself and reaches a saturation value of 275 mV. Such a device has great potential to be used in future energy storage devices, such as hybrid cars and medical devices.

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