RESEARCH ARTICLE OPEN ACCESS

Graphene Coated Solar / Ultracapacitor Driven Car

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Abstract
This paper proposes a technique of thin film graphene solar cell coating with anti reflecting layer of titanium dioxide for absorbing the light energy. Ultra capacitor/super capacitor is used as a storage element in this paper, which is a excellent storage device as per now. The normal car battery can be replaced by ultra capacitor. The absorbed light energy is converted into electricity which will drive the car.
Keywords-graphene, titanium–di-oxide, solar cell coating, ultra capacitor, ultrasonic spray nozzle.

I. INTRODUCTION

Graphene is an allotrope of carbon whose structure is a single planar sheet of sp^2-bonded carbon atoms that are densely packed in a honeycomb crystal lattice. The carbon-carbon bond length in graphene is about 0.142 nanometers. The surface area of a single graphene sheet is 2630 m2/g. In addition, high electrical conductivity gives these materials consistently good performance over a wide range of voltage scan rates.

These encouraging results illustrate the exciting potential for high performance, electrical energy storage devices based on this new class of carbon material. Ultra capacitors based on electrochemical double layer capacitance (EDLC) are electrical energy storage devices that store and release energy by nanoscopic charge separation at the electrochemical interface between an electrode and an electrolyte. As the energy stored is inversely proportional to the thickness of the double layer, these capacitors have an extremely high energy density compared to conventional dielectric capacitors.
They are able to store a large amount of charge which can be delivered at much higher power ratings than rechargeable batteries.

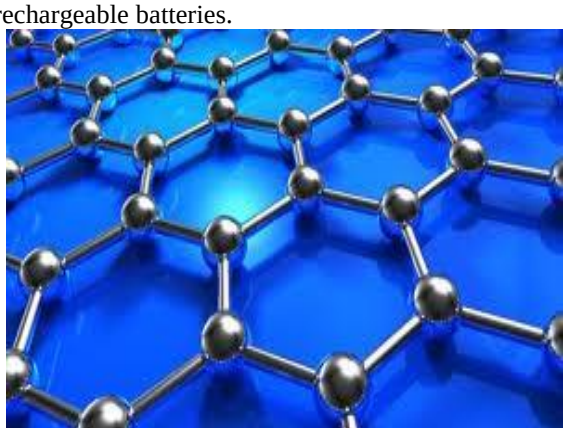


Fig1: Structure of Graphene

An ultracapacitor can be used in a wide range of energy capture and storage applications and are used either by themselves as the primary power source or in combination with batteries or fuel cells. Some advantages of ultracapacitors over more traditional energy storage devices include high power capability, long life, a wide thermal operating range, low weight, flexible packaging, and low maintenance. While the energy density of ultracapacitors is very high compared to conventional dielectric capacitors, it is still significantly lower than batteries or fuel cells. An ultracapacitor unit cell is comprised of two porous carbon electrodes that are isolated from electrical contact by a porous separator. Graphene has an excellent ability to convert solar radiation into energy. The paper indicates how the material works and why it has the potential to massively boost the efficiency of solar cells.

II. GRAPHENE SOLAR CELL

Super-efficient solar cell made from the atom-thick carbon material known as graphene. The panel is composed of photovoltaic material created by vertically stacking graphene with atom-thick transition metal dichalcogenides (TMDCs).

The resulting paper-thin material is used as an electricity-producing coating in car.

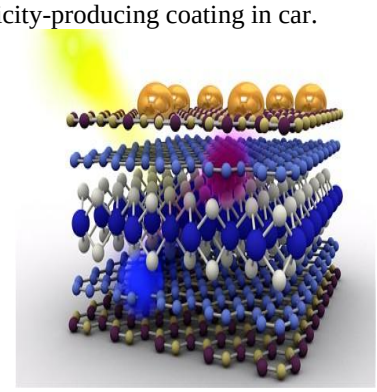


Figure 2: Graphene solar cell diagram

Graphene (light blue); dichalcogenide (white+blue); nanoparticles (gold); boron nitride (purple+beige).
The stack is composed of two outer layers of graphene sandwiching the TMDC layers. The graphene functions as an extremely efficient conductive layer while the TMDC acts as a very sensitive light absorber. The graphene with particles of gold increases light absorption. The device has a quantum efficiency of 30%.Titanium dioxide coated over the graphene acts as a anti reflecting layer can absorb more light energy and convert to electricity.

III. PROPERTIES OF GRAPHENE

These properties are what enable graphene to break so many records in terms of strength, electricity and heat conduction

Fundamental Characteristics: The carbon to carbon bonds in graphene are so small and strong that they prevent thermal fluctuations from destabilizing it.

Electronic Properties: One of the most useful properties of graphene is that it is a zero-overlap semimetal (with both holes and electrons as charge carriers) with very high electrical conductivity because the energy – movement relation (the spectrum for excitations) is linear for low energies and electrons act very much like photons in their mobility due to their lack of mass. These charge carriers are able to travel sub-micrometer distances without scattering; a phenomenon known as ballistic transport.

Mechanical Strength: Another of graphene's stand-out properties is its inherent strength. Due to the strength of its 0.142 Nm-long.

IV. SOLAR PANEL COATING IN CAR

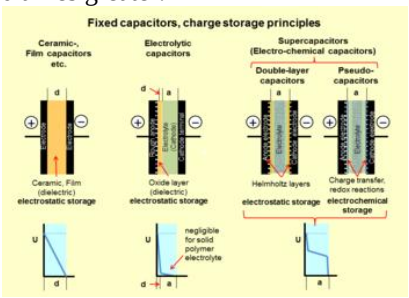
In this paper we have used a thin film nano scale graphene coated by titanium dioxide which is a anti reflecting layer, which makes the solar cell more efficient. The solar coating is done at the top of the car using the ultrasonic spray nozzle as shown in the figure.

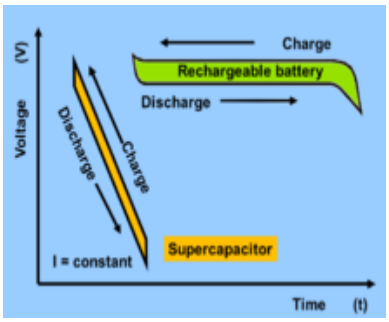
Which will absorb the solar energy at a faster rate due to the presence of titanium dioxide. The absorbed light energy is being converted into electrical energy and stored in the ultracapacitor/supercapacitor, which is a excellent power storage equipment. This ultra capacitor can be used for the power consumption in car instead of normal batteries

V. ULTRA CAPACITOR

A supercapacitor or ultracapacitor is an electrochemical capacitor that has an unusually high energy density when compared to common capacitors. They are of particular interest in automotive applications for hybrid vehicles and as supplementary storage for battery electric vehicles.

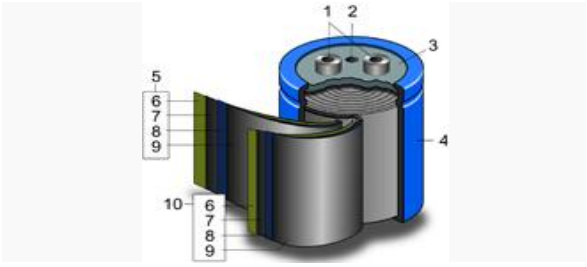
Super capacitors (SC), comprise a family of electrochemical capacitors. Super capacitors, sometimes called ultracapacitors or electric double-layer capacitor (EDLC), don't have a conventional solid dielectric. Super capacitors bridge the gap between conventional capacitors and rechargeable batteries. They have the highest available capacitance values per unit volume and the greatest energy density of all capacitors. They support up to 12,000 farads/1.2 volt,[6] with capacitance values up to 10,000 times that of electrolytic capacitors.[1] While existing super capacitors have energy densities that are approximately 10% of a conventional battery, their power density is generally 10 to 100 times greater.



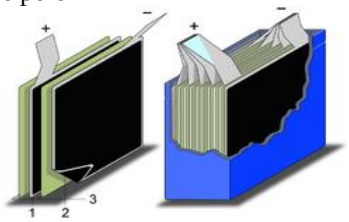


VI. CONSTRUCTION DETAILS

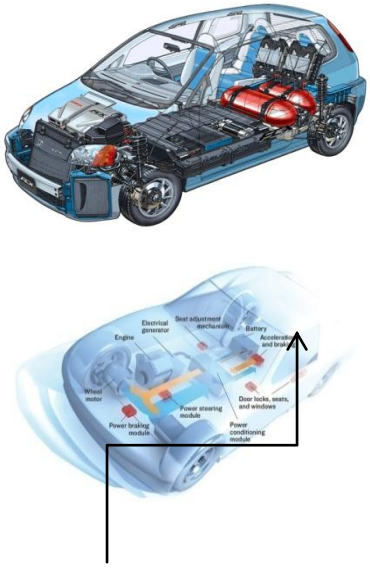
Construction details of super capacitors with activated carbon electrodes



Schematic construction of a wound super capacitors
1.Terminals, 2.Safety vent, 3.Sealing disc, 4.Aluminum can, 5.Positive pole, 6.Separator, 7.Carbon electrode, 8.Collector, 9.Carbon electrode, 10.Negative pole



Schematic construction of a super capacitor with stacked electrodes: 1.Positive electrode, 2.Negative electrode,
3.Separator



Ultra Capacitor

VII. TESTING THE SOLAR PANEL

The solar panel was tested under a constant light source in the lab, using different resistances

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Figure 9: Testing solar panel circuit diagram

Voltage V was measured across the solar panel terminals for varying resistances andcurrent was calculated using ohms law

I = V/R

Ultrasonic spray nozzle:

The inherent thinness and strength of graphene, combined with the ability to deposit thin nano layers of material uniformly using ultrasonic spray, gives rise to enormous potential for graphene in thin film functional coatings for electronics, solar cells, and even protective layers using ultrasonic spray technology.

Figure 10: ultra sonic spray nozzle

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