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Application Of Nanotechnology In Plug-In Electric Vehicles (PEV)

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Abstract:-*A plug-in electric vehicle(pev)s is any vehicle that can be recharged from an external source of electricity, such as wall sockets, and the electricity stored in the rechargeable battery packs drives or contributes to drive the wheels. PEV is a subset of electric vehicles that includes all-electric, or battery electric vehicles (BEVs), and plug-in hybrid vehicles (PHEVs).Plug-in cars have several benefits compared to conventional internal combustion engine vehicles. They have lower operating and maintenance costs, and produce little or no local air pollution. They reduce dependence on petroleum and may significantly reduce greenhouse gas emissions, depending on the electricity source, as motors are typically much more efficient than ICE. Plug-in hybrids capture most of these benefits when they are operating in all-electric mode. This paper depicts that the use of titanium dioxide nanoparticles in a polymer or more effectively with silver wire immersed in it, make it absorptive enough for efficient solar cell. This solarcell on a surface and being good transparent to visible light it can be used in any Plug-in Electric Vehicle (PEV) surface or colored body, without making changes in color of the object. This concept can be used in any vehicle to produce a live natural energy resource and hence enhancing its capabilities. This is big positive for the emerging PEV technology and also fulfills the future expectations.*

INTRODUCTION

Nanotechnology: - the manipulation and manufacture of materials and devices on the scale of atoms or small groups of atoms. The “nanoscale” is typically measured in nanometers, or billionths of a meter (nanos, the Greek word for“dwarf,” beingthe source of the prefix), and materialbuilt at this scale often exhibit distinctive physical and chemical properties due to quantum mechanical effects. Although usable devices this small may be decades away (see micro electro mechanical system), techniques for working at the nano scale have become essential to electronic engineering, and nano engineered materials have begun to appear in consumer products.A solar cell, or photovoltaic cell, is an electrical device that converts the energy of light directly into electricity by the photovoltaic effect, which is a physical and chemical phenomenon. It is a form of photoelectric cell, defined as a device whose electrical characteristics, such as current, voltage, or resistance, vary when exposed to light. Individual solar cell devicescan be combined to form modules, otherwiseknown as solar panels. The photovoltaic effect was experimentally demonstrated first by French physicist Edmond Becquerel. In 1839, at age 19, he built the world's first photovoltaic cell in his father's laboratory. In the present scenario we witness that the non-renewable sources of energy upon which the world is relying upon are at the verge of extinction. So it’s the high time now that we figure out an alternative source ofenergy which is in abundance and easily accessible and answer

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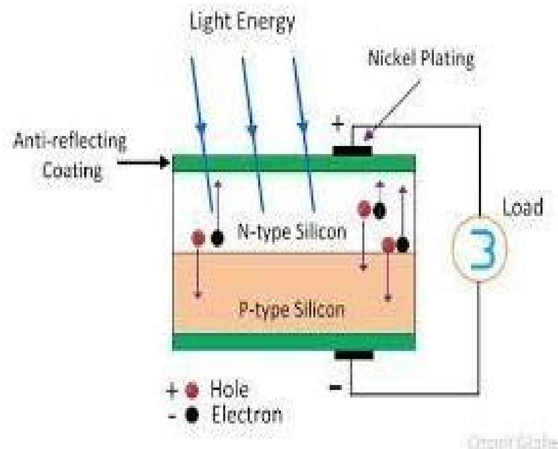
to this problem isUnquestionably, the Solar energy, recent studies show that it's the most demanded and promising option we have left with us ,but Harnessing thesolar energy at its maximum is now a hot-topic new innovation called Plug-in electric vehicle(PEV).A plug-in electric vehicle is any vehicle that can be recharged from an external the source of electricity, such as wall sockets, and the electricity stored in the rechargeable battery packs drives or contributes to drive the wheels. These vehicles have short range due to fact that they can store electric energy up to a limit.Considering all these, with the use of Nanotechnology manipulating approach and feasible engineering we can create a system capable of photovoltaic work hence producing a live source of energy.Central idea of the project lies in solar cell and its application with(Pev)s. Idea of using Si hasn't proved fruitful in the early stages ,As usage of Si was not cost effective. "***Necessity is the mother of invention***" Later, it marked with the ingenious invention of thin film photovoltaic cells(TFPV). A thin-film solar cell is a second generation solar cell that is made by depositing one or more thin layers, or thin film (TF) of photovoltaic material on a substrate, such as glass, plastic or metal. By reducing the quantity of semiconductor material used, we can reduce the cost by more than half.

A dye-sensitized solar cell (DSSC, DSC, DYSC[1] or Grätzel cell) is a low-cost solar cell belonging to the group of thin film solar cells.[2] It is based on a semiconductor formed between a photo-sensitized anode and an electrolyte, a photo electrochemical system. The DSSC has a number of attractive features; it is simple to make using conventional roll-printing techniques, is semi-flexible and semi- transparent which offers a variety of uses not applicable to glass-based systems, and most of the materials used are low-cost. Hence, being good transparent to visible light it can be used in any Plug-in Electric Vehicle (PEV) surface or colored body, without making changes in color of the object. This paper is fully focused on different fields related to TPV and their demerits and merits.

WORKING PRINCIPLES

When light reaches the p-n junction, the light photons can easily enter in the junction, through very thin p-type layer. The light energy, in the form of photons, supplies sufficient energy to the junction to create a number of electron-hole pairs. The incident light breaks the thermal equilibrium condition of the junction. The free electrons in the depletion region can quickly come to the n-type side of the junction. Similarly, the holes in the depletion can quickly come to the p- type side of the junction. Once, the newly created free electrons come to the n-



type side, cannot further cross the junction because of barrier potential of the junction.

Dye-SensitizedSolarcells(DSSC):

Operational Principal

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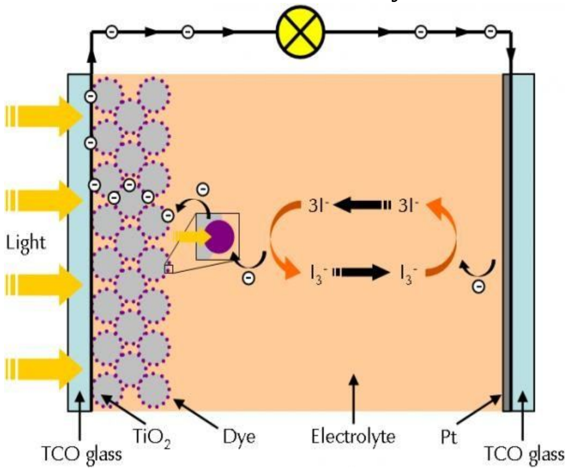
Setup

The anode of a DSC consists of a glass plate which is coated with a transparent conductive oxide (TCO) film. Indium tin oxide (ITO) or fluorine doped tin oxide are most widely used. A thin layer of titanium dioxide (TiO2) is applied on the film.
The semiconductor exhibits a high surface area because of its high porosity.

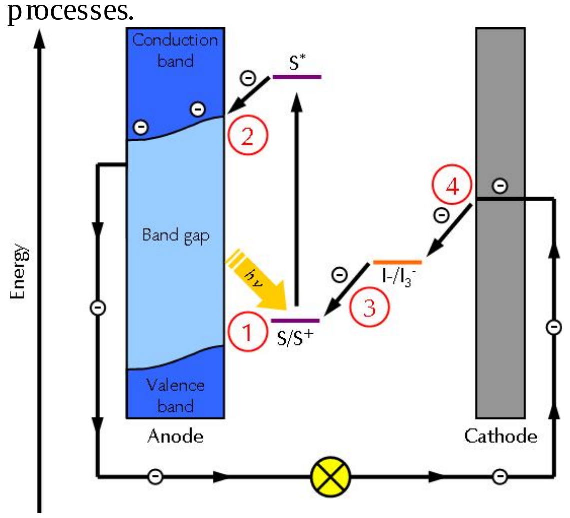
The anode is soaked with a dye solution which bonds to the TiO_2. The dye – also called photosensitizers – is mostly a ruthenium complex or various organic metal free compounds. For demonstration purposes, also plain fruit juice (such as from blackberries or pomegranates) can be used.
They contain pigments which are also able to convert light energy into electrical energy.

The cathode of a DSC is a glass plate with a thin Pt film which serves as a catalyst. An iodide/triiodide solution is used as the electrolyte.
Both electrodes are pressed together and sealed so that the cell does not leak. An external load can be powered when light shines on the anode of the dye solar cell.



Principle

As the name implies, the mechanism of dye solar cells is based on the photo electrochemical processes.
Figure shown: depicts an energy diagram of a dye solar cell. The following section describes all relevant electrochemical processes.



STEP 1: The dye molecule is initially in its ground state (S). The semiconductor material of the anode is at this energy level (near the valence band) non-conductive.When light shines on the cell, dye molecules get excited from their ground state to a higher energy state (S*),light shines on the cell, dye molecules get excited from their ground state to the excited dye molecule has now a higher energy content and overcomes the band gap of the semiconductor.

STEP 2: The excited dye molecule is oxidized and an electron is injected into the conduction band of the semiconductor. Electrons can now move freely as the semiconductor is conductive at this energy level. The excited dye molecule is oxidized electrons are then transported to the current collector of the anode via diffusion

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processes. An electrical load can be powered if connected.

STEP 3: The oxidized dye molecule is again regenerated by electron donation from the iodide in the electrolyte oxidized dye molecule

STEP 4: In return, iodide is regenerated by reduction of triiodide on the cathode iodide regenerated.

Transparency

It is a physical property of any material that allows light to pass through without interrupting it. For the solar cell it's the most important property and all depends upon the of atoms and electrons in it. However it makes that material opaque when photon gets absorbed by the material of equal BG due to bouncing of electron to higher electron shell. [13]. the key to reaching a transparent paste is to control the factors that affect transparency such as:

1. Size and arrangement of Nano-crystals.
2. Methodologies used in making paste
3. Absorbing capacity
4. Thickness

IMPLEMENTATION OF TRANSPARENT SOLAR CELL TECHNOLOGIES

Thin film photo voltaics (TPVs) technologies, thin film solar cells are the new generation solar cells that contain multiple thin film layers of photo voltaic materials. The thin film solar cells (TFSC) are also known as Thin Film Photo Voltaic cell (TFPV). The thicknesses of thin film layers are very less as (few nano meters) compared to traditional P-N junction solar cells. According to the type of photo voltaic material used, the thin film solar cells are classified into four types

Amorphous silicon (a-Si) and other thin-film silicon (TF-Si),Cadmium Telluride (CdTe), Copper indium gallium deselenide (CIS or CIGS), Dye-sensitized solar cell (DSC) and other organic solar Structure.The structure and functioning of thin film solar cells are almost same as that of normal silicon wafer cells. The only difference is in the thin flexible arrangement of the different layers and the basic solar substance used. The thin flexible arrangement of the layers helps to produce very thin form of cells that is much more efficient than the conventional silicon wafer cells.

Working

The basic substance of a photovoltaic cell is semiconductors. The semiconductor doped with phosphorus develops an excess of free electrons (usually called N type material) and a semiconductor doped with boron, gallium or indium develop a vacancy(called holes) and this doped materials known as P type materials.

These n type and p type materials combine (join) to form a Photo voltaic cell.

During the absence of light, a very small amount of atoms are excited and move across the junction. This causes a small voltage drop across the junction. In the presence of light, more atoms are excited and flow through the junction and cause a large current at the output. This current can be stored in a rechargeable battery and used for several applications based on our requirement.

Transparency is physical property consisting of mesh count, mesh opening, thread diameter, open surface and fabrication thickness as its measurement value. While our frame pressure also decide the film thickness. P25, ST21, and ST41 are commercially available TiO2 nanoparticles, can easily printed on plate with 17 µm thickness, and the results showed that the

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light passage was 60%, and the efficiency of the DSSC at the end of the fabrication of P25 TiO2 thin film was 9.2%.

However when light scattering layer is added with division of TiO2 in conc. and semitransparent layer, we achieved 18 % efficiency with thetransparency 20-23

Polymer solar cell (PSC)

Ideal TPV only can be achieved by combining polymer with the transparent silver nanowires which is non-transparent for UV and NRI but transmit the visible light. These have efficiency is 16%, and the transparency at 550 nm wavelength is 66%. Whereas NIR fluorescent dyes are also implemented in order to capture UV and NIR light, convert them into visible light, and then guide it to the edge of the glass where the solar cell is placed.

NEWPROPOSED PEV WITH PHOTO-VOLTAIC SURFACE PROPERTIES

The basic idea was to use the titanium dioxide Nano-particles in a polymer with silver wire immersed in it and on the solar cell open surface making it absorptive enough for efficient solar cell and being good transparent to visible light it can be used in any automobile surface or an air-plane surface or any coloured body, without making changes in colour of the object.PSC is the most efficient type of structure which can be used in fabrications of the photovoltaic surfaced PEV. It consists of sandwich like structure, where the outer two layers are of transparent electrodes while active material is placed between them. The outer electrode when is made up of silver nanoparticles in polymer. It blocks the UV and NIR light but visible light can pass making it more efficient.

Next to it is the active member that is actually hetero junction of the donor and accepter. It is combined called as PBDTT-DPP: PCBM. It retains the UV light along with NIR to make the structure more efficient. And at last, electrode substrate is present having ITO. At last is the back coloring layer is present having paint to reflect back the light rays passing on. However the coating of the outer layer is did using the method by spraying the AgNW on the TiO2 solgel solution. Hence it is used to connect the both layers.

CONCLUSION

Energy is essential for economic development and growth. With the rapid growth of development and the drive to expand the economy, society demands more electricity. Coupled with the realization that unsustainable energy production can have a detrimental effect on our environment. Solar energy is the most prolific method of energy capture in nature. The economic drive to make solar cells more cost effective and efficient has driven developments in many different deposition technologies, including dipping, plating, thick film deposition and thin film deposition. Typically, in order for solar energy to work efficiently and supply energy to a building, a very large amount of space is required, in the form of rooftops or land, in order to install solar panels; these solar panel space requirements are a large impediment to practical usage. This drawback drove researchers to come up with transparent solar cells(TSCs), which solves the problem by turning any sheet of glass into a photovoltaic solar cell. These cells provide power by absorbing and utilizing unwanted light energy through windows in buildings and automobiles, which leads to an efficient use of architectural space. There are approximately nine transparent photovoltaic (TPV) technologies under development, and studies regarding these

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technologies aim to achieve high transparency along with electrical performance that is compatible with solar panels that are sold in the market. The main objective of this review paper is to state all the latest reported technologies from the year 2007 onwards on transparent photovoltaic technologies with at least 20% average transmission. This includes demonstrating the process used in each technology (including the materials and the methods) and explaining its advantages and disadvantages from a performance, aesthetic and financial perspective.

Therefore, this study provides a crucial review on the latest developments in the field of TSCs.

With the use of TPV, it can conclude that the highly favorable material for our devices such as ITO, FTO glass or polymer. The highest transparency achieved was 86% with a TLSC technology, but only one percent efficient while the highest efficiency to transparency ratio was 8.2%:70% using a nanotube thin film of TiO2 for transparent DSSC. Hence it's very well feasible. However, with the use of transparent film we established such a surface that is 13-14% solar efficient and being good transparent to visible light it can be used in any Plug-in Electric Vehicle (PEV) surface or colored body, without making changes in color of the object This concept can be used in airplane or a satellite surface for solar energy generation in the form of electricity.

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