*Infrared Plastic Solar Cell*

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***Abstract –* Nanotechnology is the nexus of sciences. Nanotechnology is the engineering of tiny machines-the projected ability to build things from the bottom up using techniques and tools being to make complete, highly advanced products. It includes anything smaller than 100 nanometers with novel properties. As the pool of available resources is being exhausted, the demand for resources that are everlasting and eco-friendly is increasing day by day. One such form is the solar energy. The advent of solar energy is just about to solve all the problems. As such solar energy is useful. But the conventional solar cells that are used harness solar energy. The use of nanotechnology in solar cell created an opportunity to overcome this problem, thereby increasing the efficiency. This paper deals with an offshoot in solar cell and its advantages over the conventional commercial solar cell**.

**Keywords—Nano rods, nanocrystals, TLSC.**

1. Introduction

Infrared radiation was discovered in 1800 by astronomer sir William Herschel, who discovered a type of invisible radiation in the lower in energy than red light. Researchers at Michigan State University have developed organic salts in a transparent luminescence solar concentrator (TLSC) to absorb ultraviolet and infrared light which is guided to traditional photovoltaic solar cell situated around the edge of the plastic sheet.

Where this technology really shines is the flexibility. Because of its transparency, it could be used on an industrial scale to cover skyscrapers or integrated into your phone /tablet screen.

The efficiency of the transparent solar cell is 1%, which doesn’t sound a lot, but if you cover a whole skyscraper it could truly have a practical application. Furthermore, the efficiency could be increase to a possible 5% over time, coupled with the advent of singlet fission, which could boost efficiency by a further 30%, this is looking like a practical solution to the use of fossil fuels.

1. Nanotechnology

The pursuit of nanotechnology comprises a wide variety of disciplines: chemistry, physics, mechanical engineering, material science, biology, and computer science.

In order to miniaturization of integrated circuits well into present century, it is likely that present day, nanoscale or nano-electronics device design will be replaced with new designs for devices that take advantage of the quantum mechanical effects that dominate on the much smaller, nanometer scale.

Nanotechnology is often referred to as general purpose technology. This is because in its mature form it will have significant impact on almost all industries and all areas of society. It offers better built, longer lasting, cleaner, safer and smarter products for the home, for ammunition, for medicine and industries for ages. These properties of nanotechnology have been made use of in solar cells. Solar energy is really an abundant source that is renewable and pollution free. This form of energy has very wide applications ranging from small household items, calculators to larger things like two wheelers, cars etc. they make use of solar cell that converts the energy from sun into required form.

1. WORKING OF CONVENTIONAL SOLAR CELL

Basically conventional type solar cells photovoltaic (PV) cells are made of special materials called semiconductors such as silicon, which are currently the most commonly used. Basically, when light strikes the cell, a certain portion of absorbed light is transferred to the semiconductor material. This means that the energy of the absorbed light is transferred to semiconductor. The energy knocks electrons loose, allowing them to flow freely. PV cells also have one or more electric fields that act to force electrons freed by light absorption to flow in certain direction. This flow of electron is a current, and by placing metal contacts on the top and bottom of the PV cell, we can draw that current off to use externally. Conventional semiconductor solar cell are made by polycrystalline silicon or in the case of high efficiency ones crystalline gallium arsenide.

But by this type of solar cell, it is observed that, only 35% of the total sun energy falling on it could be judiciously used. Also, this is not so favorable on cloudy days, thus creating a problem. This major draw back led to the thought of development of new type of solar cell embedded with nanotechnology. The process involved in this is almost the same as explained earlier. But the basic difference lies in the absorption of the light from the sun.

Various developments regarding this field are explained below:

1. INFRARED PLASTIC SOLAR CELL

Scientist had invented a plastic solar cell that can turn the sun power into electric energy even on a cloudy day. Plastic solar cell is not new. But existing materials are only able to harness the sun’s visible light. While half of the sun’s power lies in the visible spectrum, the other half lies in the infrared spectrum. The new material is first plastic compound that is able to harness infrared portion. Every warm body emits heat. This heat is emitted even by man and by animals, even when it is dark outside. The plastic material uses nanotechnology and contains the 1st generation solar cells that can harness the sun’s invisible infrared rays. This breakthrough made us believe that plastic solar cells could one day become more efficient than current solar cell. The researches combined specially designed nanoparticle called quantum dots with a polymer to make the plastic that can detect energy in the infrared.

While further advances the new plastic solar cell could allow up to 30% of sun’s radiant energy to be harnessed through solar farms and used to power all our energy needs. This could potentially displace other source of electrical production that produce greenhouse gases like coal.

Solar energy reaching the earth is 10000 times than what we consume. If we could cover 0.1% of the earth’s surface with the solar cell, which is clear and renewable.

The first crud solar cells have achieved efficiency of today’s standard commercial photovoltaic the best solar cell, which is very expensive semiconducting laminates covert at most, 35%of the sun’s energy into electricity.

1. WORKING OF PLASTIC SOLAR CELL:

The solar cell created is actually a hybrid, comprised of tiny nanorods dispersed in an organic polymer or plastic. A layer only 200 nanometers thick is sandwiched between electrodes and can produce at present about 0.7volts. The electrode layer and nanorod/polymer layers could be applied in separate cotes, making production fairly easy. And unlike today’s semiconductor-based photovoltaic, plastic cells can be manufactured in solution in a beaker without the need for clean rooms or vacuum chambers.

The technology takes advantage of recent advances in technology specifically the production of nanocrystals and nanorods. These are chemically pure clusters of 100 to100000 atoms with dimensions of the order of a nanometer, or a billionth of a meter. Because of their small size, they exhibits unusual and interesting properties governed by quantum mechanics, such as the absorption of different colors of light depending upon their size. Nanorods were made of a reliable size out of cadmium selenide, a semiconducting material.

Nanorods are manufactured in a baker containing cadmium selenide, aiming for rods of diameter-7 nanometers to absorb as much sunlight as possible. The length of the nanorods may be approximately 60 nanometers. Then the nanorods are mixed with a plastic semiconductor called p3ht-poly-(3-hexylthiophene) a transparent electrode is coated with the mixture. The thickness, 200 nanometers a thousandth the thickness of a human hair-is a factor of 10 less than the micron thickness of semiconductor solar cells. An aluminium coating acting as the back electrode completed the device. The nanorods act like wires. When they absorb light of a specific wavelength, they generate an electron plus an electron hole –a vacancy in the crystal that moves around just like an electron. The electron travel the length of the rod until it is collected by aluminium electrode. The hole is transferred to the plastic , which is known as a hole-carrier, and conveyed to the electrode, creating a current.

1. IMPROVEMENTS:

Some of the obvious improvements include better light collection and concentration, which already are employed in commercial solar cells. Significant improvements can be made in plastic, nanorods mix, too, ideally packing the nanorodscloser together, perpendicular to the electrodes, using minimal polymer, or even none-the nanorods and jumbled up in the polymer, leading to losses of current via electron-hole recombination and thus lower efficiency.

They also hope to tune the nanorods to absorb different colors of the span the spectrum of sunlight. An eventual solar cell has three layers each made of nanorods that absorb at different wavelength.

1. APPLICATIONS:
2. Silicon possesses some nanoscale properties. This being exploited in the development of a super thin disposal solar panel poster which could offer the rural dwellers a cheap and alternative source of power. Disposal solar panels can be made in trhin sheets with about 6-10 sheets stacked together and made into a poster can help them to some extent in this regard. This poster could be mounted behind a window or attached to a cabinet.
3. Like paint the compound can also be sprayed onto other materials and used as an portable electricity.
4. Any chip coated in the material could power cell phone or other wireless devices.

One day solar farms consisting of plastic materials could be rolled across deserts to generate enough clear energy to supply the entire planet’s power needs.

1. ADVANTAGES

Plastic solar cells are quite a lot useful in coming future. This is because of the large number of advantages it has got. Some of the major advantages are:

1. They are considered to be 30% more efficient when compared to conventional solar cells.
2. They are more efficient and more practical in application.
3. Conventional solar cells are only used for large applications with big budget. But the plastic solar cells are fissile as they can be as they can be even sewn into fabric-thus having vast application.
4. Flexible, roller processed solar cells have the potential to turn the sun’s power into a clean green, consistent source of energy.
5. LIMITATIONS:
6. The biggest problem with this is cost effectiveness.
7. Relatively shorter life span when continuous exposed to sunlight.
8. Could possibly require higher maintenance and constant monitoring.
9. CONCLUSION:

Plastic solar cell help in exploiting radiation from the sun rays. They are more effective to the conventional solar cell. The major advantage they enjoy is that they can even work on cloudy days, which is not possible in the former. They are more compact and less bulky. Though at present, cost is a major drawback, it is bounded to be solved.

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