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POLYMERISED SOLAR CELLS USING NANOROD AND SCREEN PRINTING TECHNOLOGY FOR POWER GENERATION

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Abstract: High- Energy is the key input to drive the improve the life cycle. The consumption of the energy is directly proportional to the progress of the mankind with ever growing population, improvement in the living standard of the humanity, industrialization of the developing countries like India. The global demand for energy is increasing on alarming rate. The primary source of energy is fossil fuel (like coal, diesel), which are decreasing day by day due to move energy demand and there is global warming problem due to these sources. So, we need non-conventional energy sources to full fill the demand of energy .Recent improvements in the power conversion efficiencies of organic solar cells have broughrenewed attention to possibility of practical large-scale use of these devices. This paper deals with basic principal of operation of plastic solar cells and we demonstrate the implementation of the nanorod and screen printing technology in the fabrication of organic-based heterojunction solar cells.

Keywords: Polymer, Solar energy, Nanotechnology, Screen printing technology.

I. INTRODUCTION

Polymers offer the advantage of solution processing at room temperature, which is cheaper and allows for using fully flexible substrates, such as plastics Thus, replacing the silicon with polymer nanowires would make the solar cell much lighter, and eventually cheaper. The technology takes advantage of recent advances in nanotechnology, specifically the production of nanocrystals and nanorods. These are chemically pure clusters of 100 to 100,000 atoms with dimensions on the order of a nanometer, or a billionth of a meter. The electrode layers and nanorod/polymer layers could be applied in separate coats, making production fairly easy Further, using rod-shaped nano-crystals rather than spheres provided a directed path for electron transport help to improve solar cell performance. Screen-printing is a commonly used industrial technique for fast inexpensive deposition of dye films over large areas. From this standpoint, it is an ideal technology for large-scale fabrication of polymer-based solar cells. In addition, screen-printing allows patterning to easily define which areas of the substrate receive deposition. This is important, for instance, for fabricating a photovoltaic device that is integrated onto a substrate containing other electronic devices. Also, in the production of a large area energy collection system, it is necessary to fabricate many individual solar cells that are wired together. Using screen printing individual's devices can easily be defined on the same substrate in order to optimize the power generation of the entire system.

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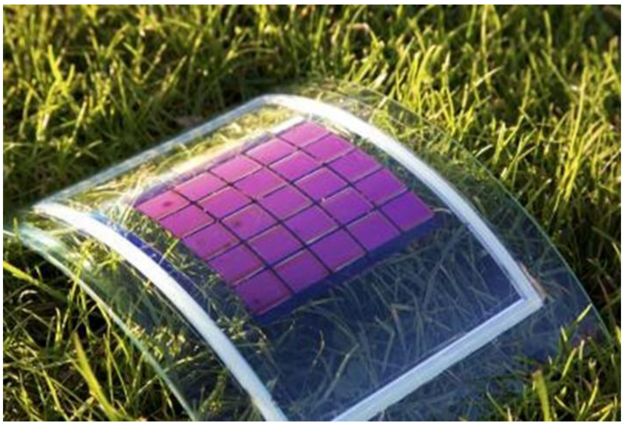

. Fig 1-Polymerised Solar cell.

II. NANOTECHNOLOGY

Nanotechnology is the engineering of tiny machines -the projected ability to build things from the bottom up using techniques and tools being developed today 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 .

One such form is the solar energy. The advent of solar energy just about solved all the problems. As such solar energy is very useful. But the conventional solar cells that are used to harness solar energy are less efficient and cannot function properly on a cloudy day. The use of nanotechnology in the solar cells created an opportunity to overcome this problem, there by increasing the efficiency. This paper deals with an offshoot in the advancement of nanotechnology, its implementation in solar cells and its advantage over the conventional commercial solar cell.

In order to the miniaturization of integrated circuits well into the present centry, it is likely that present day, nano-scale or nano electronic device designs 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.That 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 for 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 coverts the energy from the sun into required form.

III.SCREEN PRINTING TECHNOLOGY

Screen printing is a commonly used industrial technique for fast, inexpensive deposition of dye films over large areas. From this point of view, it is an ideal technology for large-scale fabrication of polymer-based solar cells. Screen printing allows patterning to easily define which areas of the substrate receive deposition. This is important, for example, for fabricating a photovoltaic device that is integrated onto a substrate containing other electronic devices. Also, in the manufacturing of a large area energy collection system, it is necessary to make many individual solar cells that are wired together. Using screen printing, individual's devices can easily be defined on the same substrate in order to optimize the power generation of the entire system. In industrial processes, films created with screen printing usually have a thickness greater than 0.5 mm. The use of screen-printing to fabricate a polymer layer with a thickness less than 100 nm, serving as the whole transport layer in an organic light-emitting diode has been recently demonstrated. Although, in this case, the printed films were not smooth and the screen footprint is visible to the naked eye. Here, we use screen printing to install an ultra thin and smooth active layer in a bulk heterojunction photovoltaic device, consisting of a conjugated polymer/fullerene blend, with a thickness of 40 nm and root-mean-square (rms) surface roughness of 2.6 nm. This device yields a power conversion efficiency of 4.3% when illuminated by monochromatic light with a wavelength of 488 nm. The structure of the bulk-hetero junction solar cell.

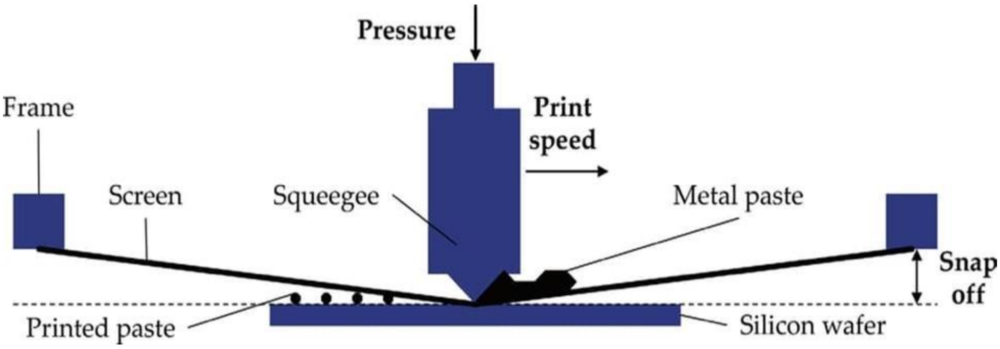

Figure 2-Screen printing technology.

IV.DESIGN OF POLYMERISED SOLAR CELL

The plastic solar cell designed is actually a hybrid, comprised of tiny nanorods dispersed in an organic polymer or plastic. The electrode layers and nanorod/polymer layers can be applied in separate coats, making production fairly easy. Significantly, using rod-shaped nano-crystals instead of spheres provided a directed path for electron transport to improve solar cell performance. These types of hybrid solar cells are reported to attain a monochromatic power conversion efficiency of 6.9 percent, one of the highest ever reported for a plastic photovoltaic device.The nanorods act like wires. When they absorb light of a specific wavelength, they create an electron plus (electron hole - a vacancy in the crystal that moves around just like an electron). The electron travels the length of the rod until it is collected by the aluminum electrode. The hole transferred to the plastic, which is known as a hole-carrier, and transfer to the electrode, creating a current. Plastic solar cell structure is the most successful structure developed, in which a blend of donor and acceptor with a bicontinuous phase separation can be formed. When the sunlight passing through the transparent electrode is absorbed by the semiconducting donor and acceptor materials in the photoactive layer, excitons (bounded electron–hole pairs) are formed, and then the excitons scattered to the interfaces of the donor/acceptor where the excitons dissociate into electrons on the lowest unoccupied molecular orbital level of the acceptor and holes on the highest occupied molecular orbital level of the donor. The dissociated electrons and holes are driven by built-in electric field and then moved to negative and positive electrode, respectively, and then collected by the electrodes to realize the photon-to-electron conversion.The absorption band of P3HT/PCBM covers the range from 380 to 670 nm, which means that the photons with energy between 2.0eV and 3.3 eV can be absorbed by the active layer, and the excitons will be formed. To make better utilization of the sunlight, active layer materials with broad absorption band is required, and for this purpose, more and more low band gap (LBG) materials have been developed 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 the plastic, nanorods mix, too, ideally packing the nanorods closer together, perpendicular to the electrodes, using minimal polymer, or even none-the nanorods would transfer their electrons more directly to the electrode. In their first-generation solar cells, the nanorods are 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 to span the spectrum of sunlight. An eventual solar cell has three layers each made of nanorods that absorb at different wavelength. Polymerised solar cells are precariously designed using nano technology to produce nano level solar cells in the form nano rods. These nano rods of cadmium selenide (CdSe) are immersed in a polymer matrix composed of P3HT (poly-3-hexylithiophene), for efficient solar energy harness. The nano rods have a thickness of about 200 nm, which can produce an output voltage of 0.7V suited for low power applications. The plastic solar cell contains a photo active layer that is sandwiched between 2 electrodes. This photo active layer is planar in nature, which increases flexibility when compared to their conventional counter parts. The nano rods in the photo active layer effectively absorb photons and generate electrons in no time. These electrons are excited by the active layer, which in turn produces electricity. In addition, the quantum confinement effect increases the efficiency by improving the electrical as well as optical properties of the material involved. The schematic of the plastic solar cell is illustrated below for reference. The proposed novel plastic solar cell is manufactured basically from nano technology as mentioned above and then compacted using screen printing technique. The nano cells that are in the form of nano rods are procured first, after which they start to harness energy through their active layers. For efficient energy conversion, it is required that all individual solar cells are wired together. To achieve this all the solar cells are required to be on the same substrate, which can be achieved only through screen printing technique. Thus, screen printing here is employed to fabricate a polymer layer with <100mm, so that it effectively serves as a whole transport layer. This

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effectively increases the efficiency by around 4.3% in comparison to commercial silicon solar cells. The figure illustrated below show the production of nano rods involving nano technology for plastic solar cells. The stand-out feature of the utilizing polymer plastics is that it allows the involvement of the above said technologies to fabricate solar cells at room temperature itself. This comforts the manufacturer as no special environment is required to be set-up for plastic solar cells manufacture.

Figure 3- A Panel of eight polymerised solar cell.

V.ADVANTAGES

- Light weight.
- Flexibility.
- Can work on cloudy days while a conventional solar cell cannot.
- Less bulky and compact while conventional solar cells are bulkier. Work well in low light conditions and under artificial

VI.FUTURE SCOPE

- It can be predicted that the efficiency of proposed solar cell can go high as in comparison to a conventional one.
- Further all critical applications that require a trustworthy back up power will rely only on polymerised solar cells.
- Development on a nano scale will lead to integrating these solar cells right from very large equipment to miniature ones.
- The installed solar farms soon will become the sole power supply to an entire region.

VII.CONCLUTION

Polymerised solar cells help in exploiting the infrared radiation from the suns rays. They are more effective when compared 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 bulkier. Plastic solar cells help in exploiting the infrared radiation from the sun's rays. They are more effective when compared 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 bound be solved in the near future as scientists are working in that direction. As explained earlier, if the solar farms can become a reality, it could possibly solve the planets problem of depending too much on the fossil fuels, without a chance of even polluting the environment. Harnessing of Non-Conventional energies is a human necessity. At the same time the solar energy at present we are tapping with the silicon cells. These cells at present they have not yet reached the economical feasibility. Hence the concept and developing a plastic solar cell would account to the economical feasibility and mass usage. The main advantage of plastic solar cell is its efficiency and wide range applications.

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