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Towards Green Energy—Solar Cells

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Abstracts -

Energy is fundamental need of a globe. Need and consumption of energy is increasing day by day. Various technologies have been improved to fulfil the need and efficiency of energy .Various countries in the world are struggling for energy. Today's energy sources are hazardous to environment as carbon dioxide and carbon monoxide are evolved during combustion of petroleum products which is one of the cause of global warming .To overcome all these world needs solar energy which is non-conventional , green energy .A tremendous amount of energy comes on the earth. Solar energy coming on Earth in one hour is equal to energy consumed by people in one year. Lot of improvement and progress going on in this field

Key Words- Photo voltaic (PV) cell, Solar cell

Introduction

The Earth receives tremendous amount of energy. The Sun is a fusion reactor that has been burning since 4 billion years. The amount of solar energy receives the earth over a three day period is nearly equal to the energy stored in all fossil energy sources. Solar energy is a free, inexhaustible source of energy. The solar professional companies are designing advanced solar power systems means in future there will be solar power in every home. The revolution has come with the invention of transistor and accompanying semiconductor technology. The solar cells are having several advantages as one of the best renewable source of energy in the world. It is nonpolluting green energy, has no maintenance and has a life of 20-30 years with no running costs .Installation of solar cells is very easy so remote rural areas can easily produce their own supply of energy. Electricity consumption has been substituted by solar power making it the obvious solar choice. Instead of extending expensive power lines into remote areas where people do not afford money to pay for conventional electricity, it is better to use solar power. There are very few disadvantages as the cost of equipment and use in cloudy atmosphere. Considering the use of solar cells we will examine them different types of solar cell 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.

Solar Cells -

Solar cells consist a semiconducting material which has a certain characteristics to absorb sunlight. Over 95% of all the solar cells produced worldwide are composed of a semiconductor material Silicon (Si). As the second most abundant element in earth's crust, silicon has the advantage, of being available in sufficient quantities. To produce a solar cell, the semiconductor is doped. Doping is nothing but introduction of chemical element into the semiconductor. By doing this depending upon the type of dopant one can obtain positive charge carriers i.e. P-conducting semiconducting layer (base) or negative charge carriers i.e. n-conducting semiconducting layer (emitter).The surface is coated with anti-reflection coating to avoid the loss of light energy due to reflection. Solar cells can be classified as first, second, and third generation cells. The first generation cells consists conventional, traditional or wafer based cells such as silicon solar cells. second generation cells consists thin film solar cells and third generation solar cells consists number of thin film technologies or emerging photovoltaic which are still in the research or development phase .

Amorphous Silicon Solar Cells (a-Si) –

Amorphous silicon (a-Si) is the non-crystalline form of silicon. These type of solar cells are first manufactured industrially. These solar cells are at low cost as these can be manufactured at low processing temperature .It is widely used in pocket calculators Amorphous silicon don't have definite arrangement of atoms in the lattice .These can be fabricated by coating the doped silicon material to the backside of the glass plate.

Cadmium-Telluride (Cd-Te) solar cell –

Cadmium-telluride (Cd-Te) photovoltaic are cheaper, economically viable photovoltaic (PV) Devices. Cd-Te has high chemical stability and has band gap of nearly 1.5 eV. [4] Because of good band gap makes absorption of light easier and enhances its efficiency. But cadmium is one of the six deadliest and toxic elements known. If Cd-Te dust is inhaled or it is handled improperly without appropriate gloves and other safety precautions .Cd-Te is less toxic than elemental cadmium and it does not pose a major environmental problem.

Concentrated solar cells: A concentrated photovoltaic system converts light energy into electrical energy in the same way as traditional or conventional methods. In the concentrated cells large amount of solar energy is collected into a small region over the PV solar cell by using advanced optical system. Here large mirrors and lens arrangement to focus sunlight rays onto a small region on the solar cell increase maximum efficiency. By focusing large sunlight onto a small region produces a large amount of heart energy. [5] This heat energy is taken towards power generator by heat engines. Concentrating photovoltaic (CPV) modules work as the same way as conventional or traditional way except that they use advanced optical system to concentrate the sun onto solar cells.

Copper- Indium - Gallium -Selenide (CIGS) Solar Cells -

CIGS is a four compound semiconductor consisting copper-indium-gallium-selenide solar cell or CIGS in short .As compared to Cd-Te type thin film solar cell , CIGS solar cell has higher efficiency .A copper-indium-gallium-selenide solar cell or CIGS cell is a thin film solar cell used to convert sunlight into electric power .CIGS thin film solar cell is formed by copper, indium , gallium, and selenide thin layer on glass or plastic along with electrodes on the front and backside to collect current[6] .Along with cadmium-telluride and amorphous silicon solar cells CIGS is also an

important thin film PV technologies . CIGS layers are deposited on flexible substrates enables CIGS layers thin enough to be flexible.[7] Low temperature deposition of CIGS cells on glass producing highly flexible, light weight solar panels.

Dye-Sensitized Solar Cells –

Dye-sensitized solar cells are a third generation photovoltaic (solar) cell that converts any visible light into electrical energy. Dye sensitized solar cells (DSSC) were invented by Professor Michael Graetzel and Dr Brian O'Regan at Ecole polytechnic Federate de Lausanne (EPFL), Switzerland in 1991. It is a broad range electronic device which produce electricity in a wide range of light conditions which converts both artificial and natural light into energy. It is also a thin film solar cell having low cost. It is based on a semiconductor formed between a photosensitized anode and an electrolyte. It is a simple solar cell having so many uses which are not applicable to glass based systems and most of the materials used are of low cost .

Nano Crystal Solar Cells –

In Nano crystal solar cells substrate is coated with Nano crystals. Nano crystal solar cells are also called as quantum dots (QD) solar cells. Nano crystal solar cells are composed from transition metal groups having size of Nano crystal range made of semiconducting materials. A thin film of Nano crystals is obtained by spin coating process. [8] In this process a given amount of quantum dot solution is placed onto a substrate. After rotating the solution spreads uniformly and required thickness is achieved. It is observed that efficiency of Nano crystal solar cells is doubtful, therefore large scale manufacturing of Nano crystal solar cells is not suitable.

Polymer Solar Cells -

In solar cells organic material such as conjugated polymer is used to absorb the solar light. The basic principle behind the polymer solar cell and other form of solar cell is the same as conversion of electromagnetic radiation energy (light energy) into electrical energy (current) which is a physical phenomenon called as photovoltaic effect .This conversion is possible with the help of semiconductors . Silicon is the perfect example of semiconductor used in most solar cells. Like silicon polymer can also behave as semiconductors discovered by Alan J. Hedger, Alan MacDiarmid and Hideki Shirakawa received the Nobel Prize in chemistry in the year 2000. According to them conjugated polymers are able to transfer electron after doping with iodine forming solar cells from polymers and thus a new research area was born. In the latest development of polymer materials for capturing solar power researchers successful in 3.0 % for PPV type PSCs. This particular property of PSCs is used in the formation of stretchable solar devices (ex. Textiles and fabrics).

Conclusion -

To sum up, solar energy can be considered as the future energy source of India and of the World. It is a green energy or pollution free energy. It will illuminate all cities and villages of India and also of the world .Solar power production has been increased as one of the most demanding renewable source of energy. It is quiet superior option compared to mine coal, nuclear energy or petroleum products. It is an alternative source of energy to meet high energy demand of the world .To fulfil the energy demand of the world still research is needed to increase the efficiency of solar cells. QD of semiconductors based solar cells can convert more than 60% of whole solar spectrum into electric power. The

polymer based solar cells are also a good option to produce solar power. However the degradation of polymer over time is a matter of concern. The conversion efficiency of a solar cell with quantum dots could be improved from 30% to 40% and beyond.

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