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PREPARATION OF PAPER PRINTED PHOTOVOLTAIC CELLS

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ABSTRACT

An Solar energy is a renewable method for the energy production. The use of solar energy is increasing day by day and share of solar energy is increasing in the power sector of India. But as per pollution increases with energy consumption the need of solar energy will goes on increase in recent future as solar energy is a best option in both thermal and photovoltaic energy conversion processes. Photovoltaic cells are compact and has no movable parts which provides them effectiveness and easy handling. For providing further simplification the paper photovoltaic cells have been developed. This paper provides a review on the development and applications of paper photovoltaic cells.

KEYWORDS: Renewable Energy, Solar Photovoltaic Cells, Paper Photovoltaic cells, 3P.

INTRODUCTION

Increasing energy demand and depletion of the environment are the major issues from last few decades. The depletion of fossil fuels can lead world to energy crisis, all these problems can be solved if renewable energy sources are used [1]. The solar energy is a promising type of renewable energy, in which energy from solar radiation is converted into useful means. There are two types of the solar energy, first one is solar thermal energy in which heat from solar energy is collected and used for various applications and second one is Photovoltaic energy in which light is converted into electricity. PV cells are sophisticated energy production device which converts light into electricity. Current design of PV cell has a solid construction and it has five layers of Back electrode, P type electron, N type electron, anti reflection coating and front electron. The back electrode is used for backing support and thin layer of semiconductors are applied on the backing material. This increases weight of the photovoltaic cells, rigidity of the solar cells creates difficulty to adjust the cells in compact space. Also the cost of the solar panels is a major issue, even though the government provide subsidy to increase the usage of solar energy, the cost of solar cells keep solar energy out of the grasp of large population. Hence there is a requirement of compactable, flexible and most importantly cheap solar cells. To solve all these problems a research team in MIT introduced a new technology to manufacture photovoltaic cells, called as “paper printed photovoltaic cells” or “Solar papers”. This new technology provides flexibility, ease in manufacturing, compatibility of cells and most importantly it reduces cost of the solar cells.

MATERIALS AND METHODS PAPER PRINTED PHOTOVOLTAIC CELL

Paper photovoltaic cells has very simple mechanism, in this solar cell can be printed on the simple paper of any kind like printing paper, notebook page or news paper as shown in fig. 1. A specially designed solar cell printer is used to print solar cell and when printing paper is passed through solar printer different layers of solar cell get deposited on the surface of printer and by spraying photovoltaic material on the paper in vacuum. All five layers of the PV cells get deposited one by one on the surface of paper and from the other end a solar cell will come out of the printer. If wires or any sort of conductors are attached to the connection points at paper a electricity can be produced from the solar paper. These solar papers provide us simple, cost effective and flexible production of solar cells. These paper cells can be used for providing energy to small scale devices or the places where carrying conventional solar cells is difficult as solar papers provides excellent weight reduction as there is no electrodes, backing material or supporting structure in paper cells which gives it a edge in transportation also paper photovoltaic cell has advantage that it can be printed at the place of application itself.

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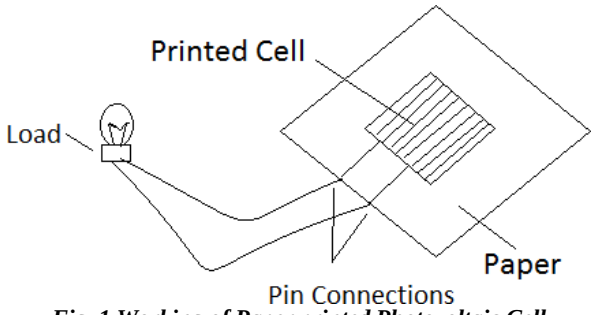

Fig. 1 Working of Paper printed Photovoltaic Cell

Due to all these characteristics solar papers has tonnes of advantages over conventional process of photovoltaic cell manufacturing process. But the greatest advantage of paper printed photovoltaic cell is that the cost of these cells is very much low as compare to conventional cells as conventional PV cells require strong supporting and backing materials.

MANUFACTURING of PAPER PRINTED PV CELLS

The solar cells are very useful as it has no mechanical moving parts which lead to low maintenance and greater life. The solar cells can generate power up to 25 years [2]. The photovoltaic is a Greek word which literally means electricity (voltaics) from light (photo). Photovoltaic cell is a device which converts sunlight into electricity using semiconducting materials. The energy from light (photons) is transferred to PV cell which allows flow of electron through external circuit attached to it. This is the free energy which does not require any operating cost but lower efficiency and high production cost are the major issues in front of the PV cell industry. So in order to increases usage of PV cell low production cost and high efficiencies of PV cell should be there. Use of different printing process lowered the cost of production and increased the efficiency of the PV cell. The main printing processes used for the printing PV cells are screen printing, inkjet printing.

The screen printing is a popular method of printing solar PV cells. In screen printing uses stencil to print same image again and again repeatedly. In this a mesh coated with light sensitive material is used to capture image in light to make stencil. By using this stencil same image can be printed over and over until screening material on stencil is consumed. In screen printing process printing can be done on paper, plastic, glass etc. The simplicity and versatility of screen printing make it suitable for printing of solar cells. In Screen printing, repeated printing can be done on the paper and different layers of solar cells can be printed using series of printing setup. Its versatile nature makes this process considerable for solar cell printing. [7]

Inkjet printing is one of the newly developed and most experimental method in development of solar cells, this method has great potential in printing of solar cells. Inkjet printing technology Is most common type in the domestic printing bussniess. In this printing method ink nozzles (one nozzle for each color) spray ink droplets on the paper and printing is done. This mthod can be very useful in solar cell printing as number of layers of PV cell has different materials which can be sprayed on the paper according to its layer arrangement and soalr cell can be printed. Inkjet printing is currently used for production of both flexible thin film solar cells as well as more conventional heavy cells.

CONCLUSIONS

This paper printed PV cells can be used for many applications like small scale power production and this new technology will provide great benefits for transportation and instant production of the PV cells. This new development in production of PV cell will reduce weight of PV cell as well as production cost of the PV cell will reduce. Solar printed photovoltaic cells will increase the popularity and usage of solar photovoltaic energy.

As placement and mounting is ridiculously easy, solar paper printed PV cell will be capable of producing energy anywhere like roofs, windows, doors, gardens, vehicles.

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