



REVIEW ON SOLAR PHOTOVOLTAIC CELLS

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Abstract: Photovoltaic solar cells are thin silicon disks that convert sunlight into electricity. These disks act as energy sources for a wide variety of uses, including: calculators and other small devices; telecommunications; rooftop panels on individual houses; and for lighting, pumping, and medical refrigeration for villages in developing countries. Solar cells in the form of large arrays are used to power satellites and in rare cases, to provide electricity for power plants. PV cells or solar cells, convert sunlight directly into electricity. PV cells are assembled into flat plate systems that can be mounted on rooftops or other sunny areas. They generate electricity with no moving parts, operate quietly with no emissions, and require little maintenance. Photoelectric cell, defined as a device whose electrical characteristics – such as current, voltage, or resistance – vary when exposed to light. Given review work is on, working principle, materials used in making of PV Cells and its application. Review will provide all primary information which is needed in manufacturing of solar PV cells with its advance technology. Present review gives all beneficial data to elementary research community and students.

Index Terms –. Photovoltaic Cell, Current, Voltage, Resistance, Silicon, Working Principle

I. INTRODUCTION

Current science is focus on renewable energy sources like solar, biomass, wind, hydropower, geothermal, etc. The reason is that renewable energy sources can only satisfy the energy demand of human, social and economic development since fossil fuels are limited in natural resources and causing global warming in the environment. The Sun is source of abundant energy. Solar energy is available to the whole world, thus this make it highly desirable and suitable alternative to fossil fuels (*Technologies and public opinions IEEE Access*, 63837-63851, A Q 2019). We are getting large amount of energy from the Sun out of which only a small portion is utilized. Solar energy has emerged as a front runner in sustainable fuel alternatives as part of an effort to move away from fossil fuel energy consumption. Solar cell technology is one of the most promising approaches to directly convert solar energy into electricity, and thus protect our environment from the greenhouse effect and reduce the carbon footprint proved by many researchers. Using the Solar PV cell technology is also reduce the overall cost (S. Rehman, A. Bader Maher, and S. A. Al-Moallem, 2007). Looking forward, PV cell development will continue to grow as the global energy portfolio transitions more towards renewable energy. PV's share of total electricity supply will increase significantly because of its low cost relative to other sources (Gregory M Wilson *et al*, 2020). The solar cells or the photovoltaic cells are the electrical devices that convert the energy of sunlight into the electricity by the photovoltaic effect which is the ability of matter to emit the electrons when a light is shone on it. Sunlight is composed of photons, or particles of solar energy. These photons contain varying amounts of energy that correspond to the different wavelengths of the solar spectrum. A PV cell is made of semiconductor material. When photons strike a PV cell, they may reflect off the cell, pass through the cell, or be absorbed by the semiconductor material. Only the absorbed photons provide energy to generate electricity.

REVIEW METHODOLOGY

Given review article is a survey report on Solar Photovoltaic cells. It gives an overall idea of current thinking on the theme, unlike an original research article. Present review provide a comprehensive foundation of a topic and explain the current state of knowledge. The presented data were collected from online reading and from research scholar articles. Most of the references of given contain were compared and summarized from PubMed and Google Scholar. Offline tutorial is also used in current study as Data sources.

RESULTS AND DISCUSSION

Function of PV Cells

The photovoltaic solar cells are thin silicon disks that convert the sunlight into the electricity, and these disks act as energy sources for a wide variety of uses. The solar cells convert the sun's energy into the electricity, They are building blocks of photovoltaic modules, They are known as the solar panels, Photovoltaic (PV) devices generate the electricity directly from sunlight via an electronic process that occurs naturally in certain types of material that called the semiconductors. The electrons in these materials are freed by the solar energy and they can be induced to travel through an electrical circuit, They can power the electrical devices or send the electricity to the grid, the solar cells produce the direct current (DC) which is converted to alternating current (A-C) by

using the inverter. The modern solar cells are made from crystalline silicon or thin-film semiconductor material, the silicon cells are more efficient at converting the sunlight to the electricity but they have higher manufacturing costs. Photovoltaic cells generate direct current (DC) electricity. This DC electricity can be used to charge batteries that, in turn, power devices that use direct current electricity. Nearly all electricity is supplied as alternating current (AC) in electricity transmission and distribution systems. Devices called *inverters* are used on PV modules or in arrays to convert the DC electricity to AC electricity. PV cells and modules will produce the largest amount of electricity when they are directly facing the sun. Most PV systems have modules in a fixed position with the modules facing directly south (in the northern hemisphere—directly north in the southern hemisphere) and at an angle that optimizes the physical and economic performance of the system.

Advance technology in solar research

Bifacial Solar cells: Passivated Emitter Rear Cell (PERC) is an advanced kind of solar cell technology that could give more efficiency. Bifacial solar cells are capable of generating electricity not only from the sunlight incident on the front surface of a solar cell but also from reflected sunlight at the rear part.

Floating PV technology: In order to obtain solution for wastage of large landscape, large water bodies can be used to erect PV cells. In India, Floating PV technology project would be developed and its further development would be pursued. Floating PV systems are faster to install than land-based installations, and have been shown to reduce water evaporation while improving water quality.

Integrated PV panels: PV panels integrated in building architecture would be providing solution to bulky solar panel arrays, installation and maintenance difficulties.

Solar Trees: Like natural trees, solar trees could be erected, which would be capable of converting almost whole amount of incident sunlight and producing electricity.

Agro-photovoltaic: Same agriculture land can be used for growing crops as well as for solar panel installation.

Solar powered automobiles: Solar powered automobiles provide an opportunity to move away from fossil fuels for these people. The integration of photovoltaic panels on cars is becoming more feasible and in demand due to new advancements in PV technology, and in response to rising fuel prices (Rizzo, Gianfranco2010). These vehicles will be efficient solutions to environmental issues and saving energy.

Heterojunction technologies or SmartWire

Heterojunction technology (HJT) applies layers of thin-film silicon on both sides of a silicon solar cell. The layers increase the light conversion and can bring the efficiency of the silicon cell up to 25%.

Insolight panel coating

Swiss start-up *Insolight* has developed a technology that uses hexagonal lenses in the protective glass that coats solar panels to concentrate light and produce more energy. The technology has reached an efficiency of 30%, which translates to 40% more earnings for solar developers.

Current research work

“Solar cells: in research and applications”	Shruti sharma, kamlesh kumar jain, ashutosh sharma, 2015
“types of solar cells and application”	Askari mohammad bagher, mirzaei mahmoud abadi vahid, mirhabibi mohsen, 2015
Book of “wind and solar power plants”	Mukund patel, crc press
Book of “solar energy”	Dr. S. P. Sukhatme

Conclusion

Photovoltaic technologies are the vital components in solar power generation. Solar energy is consider as the most economical and clean alternative-energy-source, and with advancements in solar technology is leading from last four decade. Solar Photovoltaic technology deals with conversion of incident sunlight energy into electrical energy. Feature will be faced with the biggest demand for energy across the globe, with its huge uptake in industrialization, as well as increasing economy and population. It is going to be utmost need of the time to increase the use of renewable energy to fulfill the demand of new generation. The work will continue and will be continue with some new and new arrival of thoughts and ideas of scientific community.

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