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PAVING THE WAY TOWARDS MOST EFFICIENT SOLAR CELL DEVELOPMENT

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ABSTRACT

This article provides a possible idea to increase the efficiency of a solar cell by avoiding much reflection of light from cell's surface. Natural photonic architectures, found in transparent wings of some insects may help us to design a surface with maximum transparency based on shape, size, and organization of comprised photonic architectures. Utilizing the explained fact, a surface with maximum transparency can be evolved and used as an antireflective for solar cells. Article deputizes the concept of light trapping and provides a valid statement regarding mimicry of the best available design from nature to enhance the efficiency of a solar cell.

KEYWORDS: Natural Photonic Architectures, Solar Cell, Transparent Wings, Light Trapping, Transmissivity

INTRODUCTION

Energy drives the World. Dependency on Fossil fuels for the energy is not a wise thinking. Therefore, our attraction towards renewable energy sources has drastically increased. Solar energy is one of the best options to replace the fossil fuels. The technology, being used for solar energy conversion is almost free of noise, toxic pollution, and global warming causing secretions. In spite of availability of huge energy from sun, we're not able to consume it properly because of poor conversion efficiency of a solar cell. It is evident that maximum light, directly from Sun, must be trapped in order to increase the conversion efficiency. For this, highly anti-reflecting surface is required. Study of the transparent wings of some insects shows their antireflection behavior. Actually, antireflection behavior comes from photonic structures found in wings.

METHOD

Solar cell directly converts optical energy into electrical energy. A continuous research is going on to improve its conversion efficiency which is fairly low at present. Therefore, an improvement of the energy conversion efficiency along with reduction in the cost of solar cells is major concerns in researching solar cell. There can be many reasons which are responsible for lower efficiency. Some but most important are- reflection of light from cell's surface, poor absorption of light by active medium, fluctuations in operating temperature of used materials.[1,2]

A cell's efficiency can be increased by minimizing the amount of light reflected away from the cell's surface.[3] This means that a broad spectrum of light must encounter the cell effectively. By considering this aspect, I want to address some questions- Can we minimize this reflection from the surface to reach at optimum conversion efficiency? Can we improve the way of light trapping which will help us to find the optimal efficiency?

To find the solution, observing the nature may be proven to be very beneficial. We all knowNature is a stockpile of knowledge. We always used to learn from it. Several natural phenomena have been used to perform artificially and the ripeness changes the living performance. This comes under Biomimetics i.e. extracting good designs from nature. Currently, natural photonic architectures, as a template, are being used effectively for advanced light trapping. Natural architectures on the transparent insect's wings can be very useful to understand the design of photonic nanostructures that may help us to create efficient solar cells and other photonic devices. Shape, size, and organisation of photonic architectures play a crucial role in light transmission through it. This will help in creating antireflective for a solar cell.[3,4,5,6,7,8]

Considering this context; one can do experimental as well as theoretical works in laboratory to utilize the above concept for quantum dot solar cell or silicon solar cell or perovskite solar cell or tandem[9]. By creating noise in shape, size, and organisation of photonic architectures, transmission variation through it can be observed.Reaching up to a photonic architecture similar to the natural one will help us to find the desired Transmissivity. And Transmissivity will define light trapping. Thus, avoiding or minimizing reflection from surface will definitely increase the conversion efficiency.

CONCLUSIONS

Whole discussion was based on trapping of light utilizing photonic structures. Mimicking the best design from nature will help us to trap light effectively. Maximum transmissivity of cell's surface will minimize the reflection from surface and will allow a broad spectrum of light to encounter with gain medium. Consequently, conversion will increase and thus efficiency

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