OPTIMIZATION OF MULTILAYER ANTIREFLECTION COATING FOR SOLAR CELLS

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ABSTRACT

Photovoltaic is best known as a method for generating solar power by using solar cells packaged in photovoltaic modules, often electrically connected in multiples as solar photovoltaic arrays to convert energy from the sun into electricity. To explain the photovoltaic solar panel more simply, photons from sunlight knock electrons into a higher state of energy, creating electricity.

Photovoltaic solar power is one of the most promising renewable energy sources in the world. Compared to nonrenewable sources such as coal, gas, oil, and nuclear, the advantages are clear or it's totally non-polluting, has no moving parts to break down, and does not require much maintenance. A very important characteristic of photovoltaic power generation is that it does not require a large scale installation to operate, as different from conventional power generation stations. Power generators can be installed in a distributed fashion, on each house or business or school, using area that is already developed, and allowing individual users to generate their own power, quietly and safely.

The performance of a photovoltaic array is dependent upon the intensity of the sunlight and also the material used for the solar cell device itself. The use of antireflection coating (ARC) in solar cell technology is the one capital importance in the improvement of the efficiency of semiconductor solar cells.

By using the ATLAS simulator of Silvaco TCAD tools, the simulation of external quantum efficiency can be obtained. This project presents the effects of Silicon dioxide (SiO_2) and Silicon nitride (SiN) used as an antireflection (AR) coating for solar cell. The ATLAS simulator of Silvaco TCAD tools was used to simulate the photovoltaic cells. Basically, this project describes the simulation of highest quantum efficiency for solar cell with double layer SiO_2-SiN antireflection coating. The same parameter was investigated for triple AR coating (SiO_2-SiN-SiN) as well. For photovoltaic applications, the refractive index, and thickness are chosen in order to minimize the reflection.

ATLAS device simulator by Silvaco International was introduced for used as a tool in modeling solar cell. The ATLAS software tool was developed by Silvaco to be used for the design of solid state microelectronic devices. This ATLAS simulator extracts the electrical characteristics of a solar cell based on virtual fabrication of its physical structure, allowing for direct manipulation of materials, dimensions and dopings.

Solar cells that use antireflection coating (AR coating) can improve their efficiency. Antireflection coatings are important in order to reduce the reflection of light so that more light can be absorbed by the solar cells. The material used for AR coating also important to give the lowest reflection in improving the efficiency. In ATLAS simulator the ratio of available/source photocurrents is often known as external quantum efficiency. The source photocurrent is the amount of current generated by the light source and the available photocurrent is the amount of current absorbed by the semiconductor.

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