A Review of Nanotechnologies in Solar Cells

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## Introduction

Nowadays, solar energy has gained an important portion of world’s energy market. From 1954 when the first practical solar cell was produced by Bell Laboratories, there have been significant improvements of photovoltaic devices in both manufacturing process and design of principles.

This review will introduce the theory of the basic single p-n junction PV solar cells and its limit with the band gap of materials. The multi-junction PV cell, which includes multiple layers of dopant semiconductor in microns, aims at utilizing a broader band of sun light spectrum and therefore has a higher efficiency than its single-junction predecessors. Thin film technology is another important derivative nanoscale technology applied to PV cells, which makes it possible to integrate transparent PV layers into ordinary windows or building walls.

Based on the idea of absorbing more energy from the sun light by expanding the spectrum of PV devices, more improvements are made to solar cells in nanoscale, such as nanotubes coating, quantum dot solar cell and nanocrystal solar cell.

All these technologies implemented to PV cells requires nanoscale manufacturing such as metalorganic vapor phase epitaxy (MOVPE), molecular beam epitaxy (MBE) and aerotaxy. The mass implementation of such technologies in industry may involve high cost, yet these nanotechnologies provide valuable experience in the future of high-efficiency renewable energy generation.

## Key words:

Nanotech photovoltaic cells, thin-film, quantum dots, nanocrystal, nanotubes.

## Traditional solar cells

Theory

Efficiency

## Thin-film solar cells

Scale

Nanostructures in thin-film photovoltaics

## Multi-junction photovoltaics and its nanoscale derivatives

## Nanotubes in photovoltaics

Theory

Efficiency

## Quantum dot solar cells

## Nanocrystal solar cells

## Summary