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Table of Contents

Hetero-Structured Thin Film Solar Cell -An Overview

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Abstract: **There is significant work and progresses have seen in photovoltaic (PV) for conversion of solar energy into electricity and its storage. It had observed Shockley–Queisser (SQ) limit as a setback for the simple pn-junction solar cell. Though most of the practical solar cells suffer from band interface mismatch, energy defects, radiative, non-radiative recombination losses and so could not attain the SQ limit of 34% efficiency. While advances in modeling of materials and technological developments results into multiple junctions, intermediate band, photon up and down conversion (PUC) solar cells which have shown great potential to overcome the SQ limit and could achieve up to 88% efficiency. In this paper most of the contributing parameters of thin film solar cell has been emphasized.**

Keywords- Thin-film, Photo Voltaic, Efficiency, Shockley–Queisser (SQ), Conduction Band Offset (CBO)

1. INTRODUTION

It is basically a PN-junction diode which converts solar irradiations (photons) into excited i.e. localized electrons can produce current if a closed path is form with suitable load. The generation charge carriers into semiconductor material subject to the condition of photo electric effect. In which materials are treated as a group of oscillators and it can absorb or release energy in multiples of quanta hν0 i.e. photons and equal to sum of work function and kinetic energy of ejected electron [1]. Fig1. represents generation of charge carriers due to solar irradiance. The energy incident on material $E \geq E_0$ categorically used $h\nu_0$to excite the electron and rest of incident energy $(E - h\nu_0)$ as kinetic energy of the electron.

$$E = nh\nu_0 = nE_0 \text{ ; Where } n = 1,2,3 \ldots. \quad (1)$$

2. TYPES OF SOLAR CELL

A solar cell classified in number of ways for example, on the basis of layered used i.e. number of junctions formed it typically categorized into single junction and multi-junction or hetero-junction solar cell. Similarly, uniformity of crystal structure it categorized into crystalline and amorphous solar cell while it has also classified according to fabrication process, organic or inorganic compounds or alloy used. Depending of applications, enhancements in performance, availability of materials, fabrication techniques solar cell is categories into various types. The distinguished solar cells based on materials used are introduced in fig2. The most efficient solar cells reported till date is hetero-structured GaAs Solar cell from alloy type (III-V group). But, it faces a number of drawbacks in terms of most hazardous, most expensive and less durability.

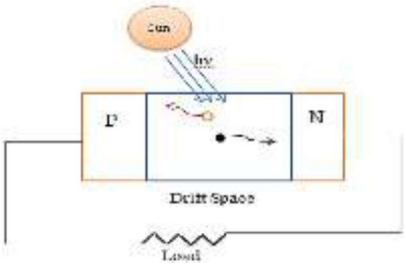

Fig. 1PN/P-I-N- Solar Cell

Crystalline Silicon Solar Cell (c-Si): Crystalline structure determines the uniform lattice (hexagonal) structure over entire range of silicon substrate. It suffers from disadvantages of large manufacturing cost to the market, and so not in everyone's price range, huge waste material produced when the silicon is cut during manufacturing, physical area to the efficiency is low, and less flexibility, polycrystalline solar cells have low efficiency so are not compatible to the market.

Amorphous (Non-Crystalline) Silicon Solar Cell: Doped Si-crystal structure which no longer found uniform known as amorphous silicon (a-Si)[2]. It lags with lower efficiency and less durability as major concern as compared to other silicon solar cells.

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