iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 8 **Issue:** VIII **Month of publication:** August 2020

DOI: https://doi.org/10.22214/ijraset.2020.31036

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 8 Issue VIII Aug 2020- Available at www.ijraset.com

Materials for Solar Energy

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Abstract: ***Energy is very important to all, without Energy we can't do any work. There are different forms of Energy sources such as Renewable and Non Renewable source. But non renewable energy resources are depleting now because of high usage, and their demand also increases day by day due to low supply of non renewable energy its cost is increases, then now renewable energy sources are used. Renewable sources are wind, solar, hydro, tidal etc. In this solar energy is commonly used now a day. In this paper we focused on different types of materials for solar energy and their efficiency.***
Keywords: Renewable Energy, Solar Energy, Solar Photovoltaic materials, efficiency, Environmental impacts.

I. INTRODUCTION

Fossil fuel storages are lowering now and cost is increases due to continuously increases in demand and low supply. Current Global Energy Scenario says that increasing electricity energy demand due to increasing Population. And fossil fuel is main contributor for pollution and Global warming, and then every country is doing effort to switch over the new renewable energy technology. When solar system concept first comes in market there is huge large cost than conventional energy sources. As a technology developed new material such as nano materials are introduced now they have saving in cost and production is increased. At the different location different season then sunlight is not equal to all places. Then it is placed as per geographical location and solar radiation data. Solar P.V materials and blocks is converted sunlight into electrical energy by photoelectric effect, the efficiency of solar cell is depends on the semiconductor material band gap and structure of PV cell. When the incident of photon energy is greater than band gap energy of semiconductor then the photons absorbed increases the energy of the valence band electrons and causes the jump of electron in to the conduction bond. As temperature increases of PV cells then decreases in band gap and reduced efficiency of panel.

A. Basic Working of Solar Photovoltaic Cell

When solar cell is get contact in the solar rays the P-N junction, light photon easily through very thin P type layer the light energy in the form of photons supply enough energy to the junction to create number of electron hole pairs. And energy is transfer to load through connections.

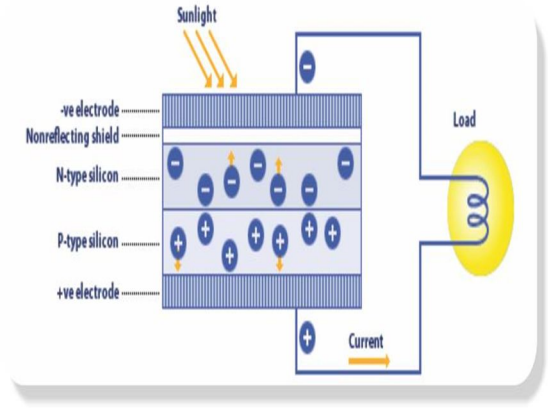

Fig 1- working of solar photovoltaic cell

B. Classifications of Solar PV Materials

The main factors impacts the choice of 90% of the world's photo voltaic solar cell are smaller variation of silicon purity, cost, space and efficiency.
Detailed classification of solar materials.

1) *Crystalline Silicon solar Cell:* crystalline silicon solar cells are most commonly used in solar panels. Its energy conversion efficiencies are over 25%. There are also two types

a) *Mono-crystalline Silicon Solar Cells (mono-si):* It is also called as single crystal silicon cell. Czocharalaski process is used to manufacture the mono crystalline solar cells.

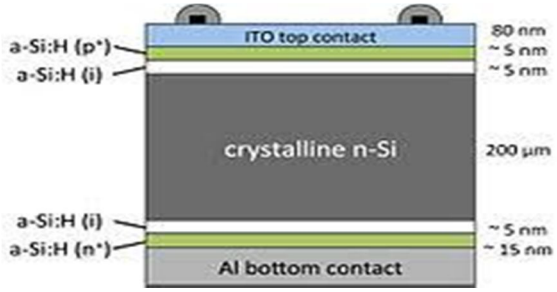

Fig 2- crystalline structure

Efficiency of mono si solar cells are 21% now it's improved to 26.7% due to the development of technology. Mono si cells are more performance giving at worm weather.

b) *Polycrystalline Silicon Cell:* Polycrystalline silicon is simple and cheaper to manufacture and it is made from raw silicon it is melted and poured into square mould. It is less efficient than mono crystalline. These materials are composition of many crystalline of different size and shapes. It includes ceramic, rock, and ice and its efficiency is 13-16% because of low quality of silicon material used.

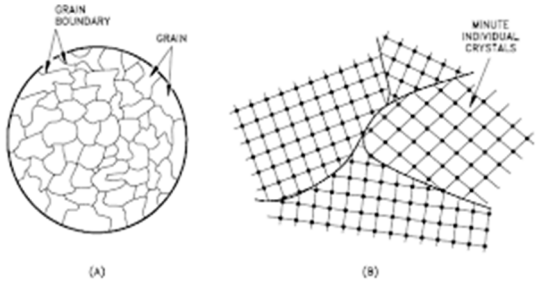

Fig 3- structure of Polycrystalline material

2) *Thin Film Solar Cells (TF):* Thin film solar cells also called as second generation solar cell. It made by one or more layers of glass, plastic or metal. film thickness varies from nanometres to tens of micrometers it is cheaper than crystalline based solar cells but more space required and efficiency of thin film solar cell is 21.7% to 23.4%

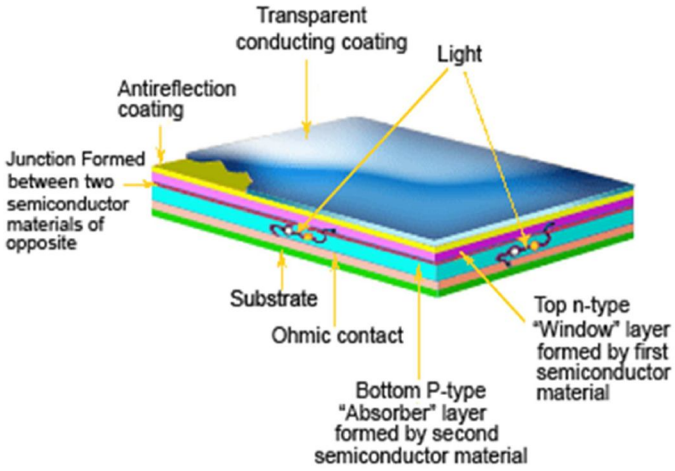

Fig 4 - thin film solar cell

3) *Amorphous Silicon (a-si):* It is a non crystalline allotropic form of silicon and good developed technology now and it is used in small scale applications especially as the power source for electronic calculators. For last 15 years it is used in electricity generation, and its efficiency is 8.8 to 10.2%.

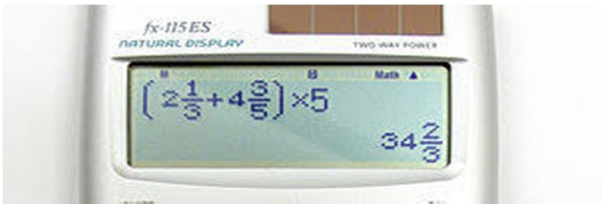

Fig 5- Application of Amorphous silicon cell

4) *Cadmium Telluride solar cell (CdTe):* Cadmium telluride PV is the only thin film technology with low cost than conventional solar cells, and it is made up of crystalline silicon. It is used in world's largest PV stations such as TOPAZ solar farm. And its efficiency is 16.1 to 22.1%.
5) *Copper Indium Gallium Selenide Solar cell (CIGS):* It is made by deposing a thin layer of copper, indium, gallium and selenium on the electrodes on the front and back for the purpose of collect current. And efficiency is 10-12% now due to modern technology it is improved to 22.8%.
6) *Organic Polymer Solar Cells:* Recent developments in solar photovoltaic technology polymer material is developed. It is flexible and it includes organic cells also called as plastic solar cells. It is light in weight and also used for windows, walls, roofs. The problem is that is low efficiency, low lifetime compared with other types of solar cells. as it is manufactured high quantity it's cost is reduced. Its efficiency is only 10% via tandem structure, but in 2018 record breaking efficiency noted is 17.3% via tandom structure

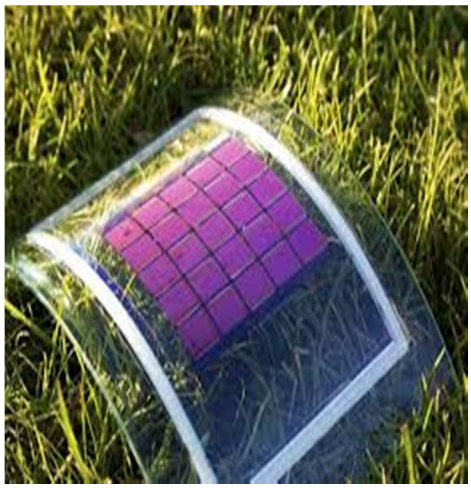

Fig 6 - organic polymer solar cell

7) *Nano Crystal Solar Cell:* The nano crystal are made up of silicon, CdTe, and CIGS materials and it's efficiency possibility up to 40-60% this is now modern technology in solar cells.

Fig 7 - Nano crystal solar cell

C. Solar PV Material and Efficiency

Sr. No	Material	Efficiency in %
1	Crystalline	25
2	Mono-crystalline	26.7
3	Polycrystalline	13-16
4	Thin film	21.7-23.4
5	Amorphous silicon	8.8-10.2
6	Cadmium telluride	22.2
7	Copper indium gallium selenide	22.8
8	Organic polymer	10-17.3
9	Nano crystal solar cell	40-60

Table 1 – comparison of material and efficiency

II. ENVIRONMENTAL IMPACTS

Fossil fuels are increase amount of carbon in to atmosphere and also increases noise, pollution and increases the global worming for this solution is use renewable energy sources, use of solar energy reduced carbon foot print and other harmful emission to environment there is no moving part then less maintenance and no noise during the operation. Use of solar energy for better sustainable green energy for future.

III. CONCLUSION

Globally solar energy usage is low as compared to fossil fuel, because of cost and efficiency. Now a day's technology was developed day by day and scientist are developing new efficient material which is low cost and high quality for improving performance of solar cell. Similarly now advance materials are available in market is nano materials and organic materials if produced large quantity then it is greater saving in cost. Now a day's crystalline silicon photovoltaic technology mostly used to convert solar energy ti electrical energy because if high efficiency of crystalline silicon.

REFRENCES

[1] Gordon et al., "Editorial," Sol. Energy Mater. Sol. Cells, vol. 133, no. October 2018, pp. A1–A6, 2015.
[2] M. G. Hudedmani, V. Soppimath, and C. Jambotkar, "A Study of Materials for Solar PV Technology and Challenges," Eur. J. Appl. Eng. Sci. Res., vol. 5, no. 1, pp. 1–13, 2017.
[3] H. Gunerhan, A. Hepbasli, and U. Giresunlu, "Environmental impacts from the solar energy systems," Energy Sources, Part A Recover. Util. Environ. Eff., vol. 31, no. 2, pp. 1131–1138, 2009.
[4] G. Oliveti, L. Marletta, N. Arcuri, M. De Simone, R. Bruno, and G. Evola, "Solar energy," Green Energy Technol., no. 9783319030739, pp. 159–214, 2014.
[5] S. Sagadevan, "Recent trends on nanostructures based solar energy applications: A review," Rev. Adv. Mater. Sci., vol. 34, no. 1, pp. 44–61, 2013.
[6] R. Y. Yang, Y. P. Huang, N. Amin, and F. Sun, "Solar energy: Materials, devices, and applications," Adv. Mater. Sci. Eng., vol. 2012, 2012.
[7] T. Niewelt et al., "Taking monocrystalline silicon to the ultimate lifetime limit," Sol. Energy Mater. Sol. Cells, vol. 185, pp. 252–259, 2018.
[8] G. P. Smestad et al., "Reporting solar cell efficiencies in Solar Energy Materials and Solar Cells," Sol. Energy Mater. Sol. Cells, vol. 92, no. 4, pp. 371–373, 2008.
[9] J. L. Cruz-Campa et al., "Microsystems enabled photovoltaics: 14.9% efficient 14 μm thick crystalline silicon solar cell," Sol. Energy Mater. Sol. Cells, vol. 95, no. 2, pp. 551–558, 2011.
[10] Adam De Greed, "Materials Used in Solar Panels," AZO Mater., 2015.
[11] M. R. S. Shaikh, "A Review Paper on Electricity Generation from Solar Energy," Int. J. Res. Appl. Sci. Eng. Technol., vol. V, no. IX, pp. 1884–1889, 2017.

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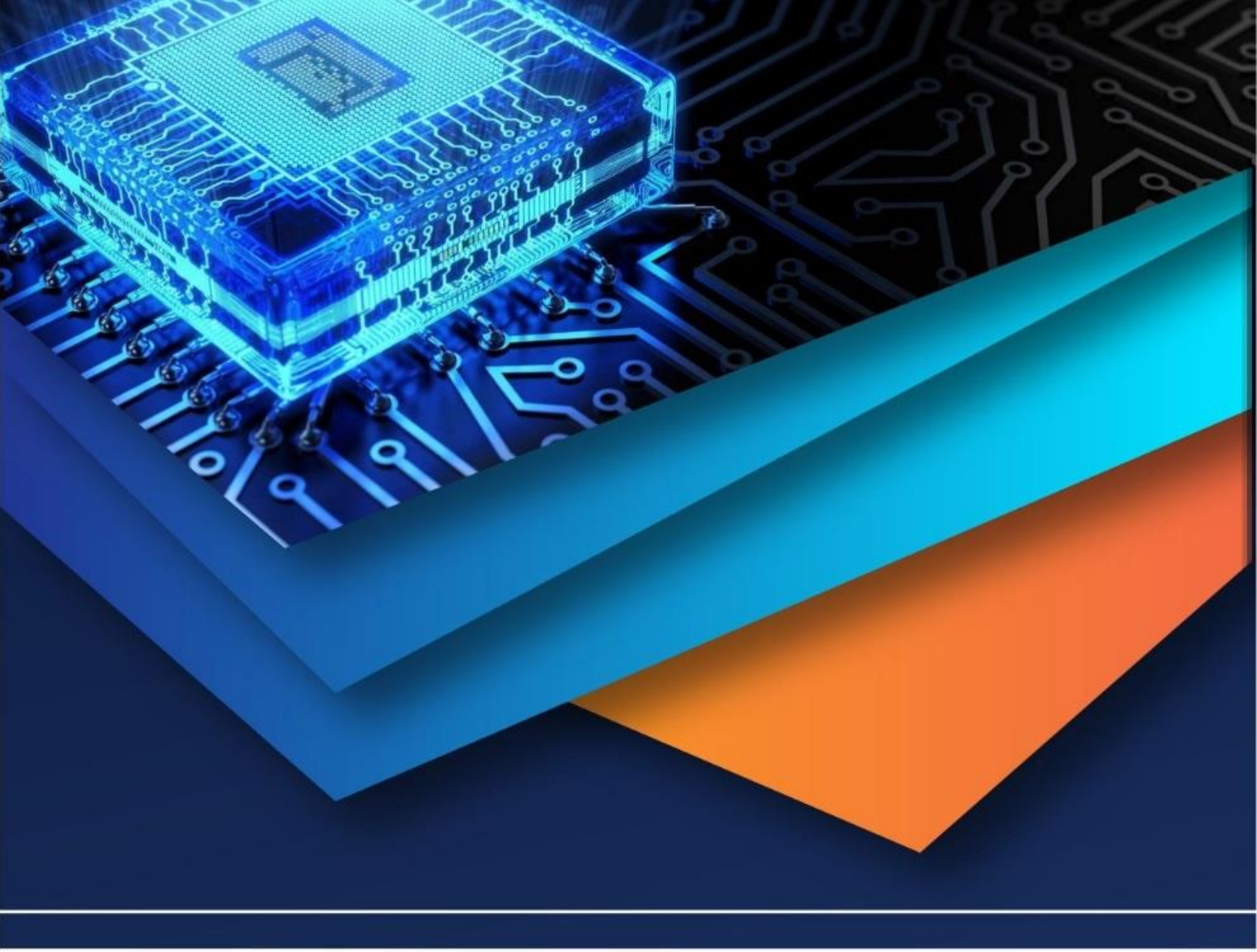

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