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A REVIEW: THIN-FILM CDTe/ CDs SOLAR CELL TECHNOLOGY

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ABSTRACT

The CdTe/ Cds photovoltaic reports a photovoltaic technology that is implemented on the use of Cadmium Telluride, a thin film semiconductor fabricated to transform solar energy into electrical energy. The working principle of the solar cell and also the comparison of the cell with Silicon based solar cell is highlighted in this underlying review paper. The advantage and disadvantage is further culminated. The present works and also the future scopes is kept on the main focus through heat treatment of the solar cell which further may increase the efficiency of the solar cell. But despite of the huge experiment every techniques implemented so far suffers from some kind of limitations. So a significant effort is needed for further success in CdS/ CdTe field.

KEYWORDS: Solar Cell, Photovoltaic, Thin-Films, Cadmium Telluride, Efficiency

INTRODUCTION

We live move and have our being under the Sun the ultimate and huge source of energy. Every morn the Sun rises with his smiling face and says with silent voice-" Dear mankind , please make use of me, I can do a lot for you, I am fatigued to remain ideal , I want to employed dear mankind." Yes, a day came ,scientists of the world realized his master voice and employ the Sun without any wages for the production of electricity which is surely one of the pillars of today's world civilization. As the world is suffering from impending death of fossil fuels and serious pollution resulted from the fuels, solar energy is now employed as one promising solution to the global energy crisis.

Among the Various ways for generating energy from the Sun, "Solar Cells" are an effective approach to convert solar energy into the electrical energy in the practical form. Quality is never satisfied with itself and always yet to be cultivated. Solar Photo Voltaic Technology is of paramount importance to fight against the worldwide pollution towards generation of electricity. Continuous R & D works are being made globally.

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The trends of development of solar cell technologies are depicted below:

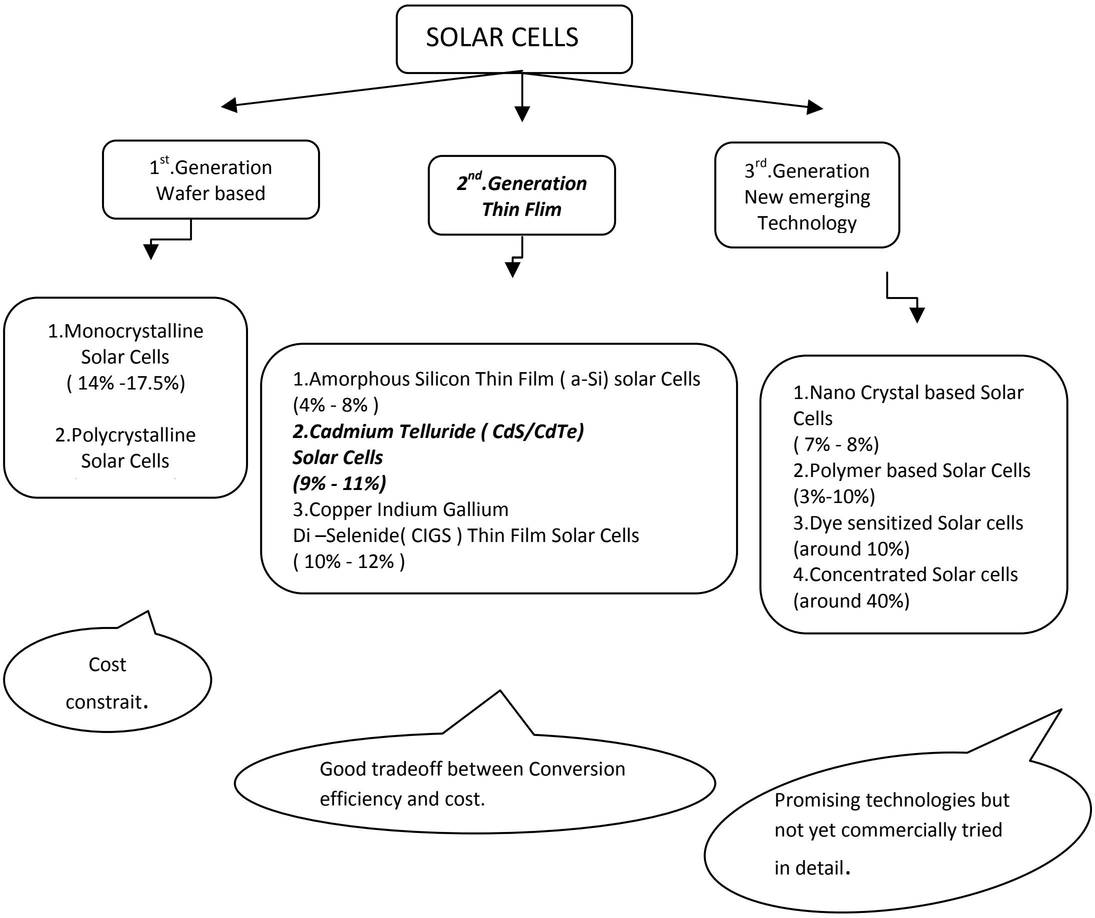

Figure 1.Generations of Solar cells

For commercial use and manufacturing in large scale price is always a prime factor to be given importance reasonably sacrificing the sole objective of the technology. In this perspective the thin film technology proves to be most promising one with so called cadmium telluride (CdS/ CdTe) based solar cells whereby a good tradeoff between conversion efficiency and cost is achieved. CdS and CdTe are two promising photovoltaic material for thin film solar cells. CdS is a wide band (2.42eV) n-type semiconductor ,which acts as a window layer and allows energetic short wave-length photons to pass to the absorber with a minimum absorption loss while CdTe (a p-type semiconductor having a near optimum band gap of 1.45eV) serves as an absorber layer. Moreover it has high optical absorption coefficient and a thickness of around 2µm absorbs nearly 100% of the incident radiation. CdS also provides a junction field for separation of photo generated minority carriers before recombination. CdS/ CdTe based solar cells have been considered as one of the most promising candidates for large scale applications in the field of photovoltaic energy conversion. So far the recorded experimental efficiency of these cells is about 16% ,-17% and the corresponding theoretical values are more than 28%.

CdS / CdTe Solar Cells are also no exception to suffer from efficiency losses. The loss factors are

1. Optical losses (Reflection losses and Absorption Losses)
2. Recombination losses.

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The solar cell efficiency (η) is calculated By using the following formula:

H (%) = (V_{OC} X J_{SC} X FF) / P_{in}

V_{OC}: Open circuit Voltage, J_{SC}: Short Circuit Current Density,

FF: Fill factor , P_{in} : Power input.

Both the Optical and Recombination losses affects the current density and hence the cell efficiency.

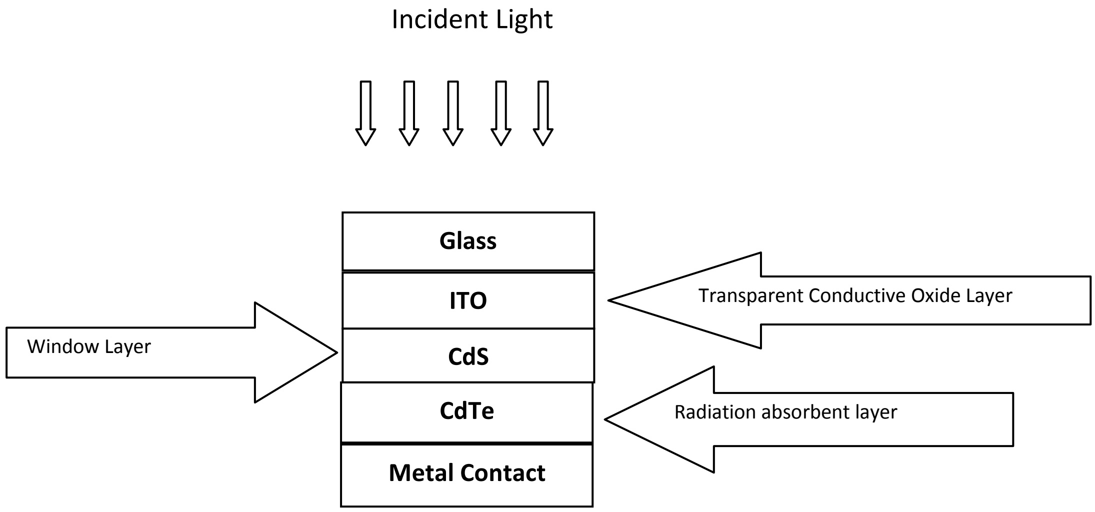

Figure 2.Schematic of a typical CdS / CdTe solar cell structure

HISTORY

Calcium Telluride was always chosen over other elements for solar cells since the early 50's. The band gap of calcium Telluride i.e, 1.46 eV makes it preferable for the energy conversions. But after a decade it was found that efficiency of the conversions can be increased to 8%(which was 5% for CdTe). By growing chemically a layer of p-Cu2-xTe on n=CdTe film, the first efficient solar cell was discovered. It was Cusano who first reported this solar cell. This cell had 6% conversion efficiency with a limitation of poor stability.

Finally in the year 1980 it was discovered that CdTe/ CdS chemically sandwiched provide a higher conversion efficiency, that is 12%. After more ten years research group discovered that the covering thickness of CdS if lowered to more than 1pm, it helps to save the part of the solar spectrum that gets wasted. The thin layer of CdS is evaporated on the upper surface of a glass substrate. The next step involves another evaporation where the layer of CdTe is evaporated with the deposited metal contact layer. At about 450° temperature in presence of CCl2 the cell is treated, this produces partially crystallized matter of each of the semiconductors.

In the year 2001 CdTe/ CdS cell showed highest solar conversion (16.5%) (Hegedus and Shafarman 2004; Desai et al.2006). With time further improvements were added to the solar cell and the stability kept improving. Finally in 2005 first solar cell reached 25 MW/Year capacity, after some failures. CdTe/ CdS cell was most preferable due to it’s better stability. The CdTe/ CdS also provided the large area cells to be reproducible. The CdTe/ CdS solar cell was compared with the thin film solar cell if CIS group, but ultimately CdS/ CdTe remained to be the leading solar cell commercially.

The most recent change that has been discovered is the thickness of the layer. It has

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been found that it can be lowered to 200A (Boer and voss 1968a, 1968b, 1968c).

STRUCTURE

At the present time, in thin film photovoltaic cadmium telluride based solar cells are one of the most favorable solar cells. Cdte is a material with a band gap of 1.45 eV which is very near to match the AM 1.5 solar spectrum. Moreover it has a high absorption coefficient which results in requirement of a few microns absorber film in making of solar cells. The very typical thin film CdTe/CdS structure is shown in the figure below. As seen in the figure the Transparent Conducting Oxide (TCO) layers such as SnO_2 or Cd_2SnO_4 are present in the structure and they are transparent to visible light. The Conductivity to transport current is very high in these TCO as well. The Cds is used as the intermediate layers .It doesn't only help in the growth of the cell but also helps to maintain the electrical properties between the TCO and CdTe. The CdTe film is the primary photo converter layer. It soaks up the most visible light within the first micron of material. In combination of these three vital parts of the solar cell-the CdTe, intermediate, and TCO layers, an electric field is produced. This electric field now transforms light absorbed in the CdTe layer into current and voltage. Metal is attached as a back contact on the back to conform electrical contacts. Finally all these layers are put down together on incoming glass and assembled into a complete solar panels in the production.

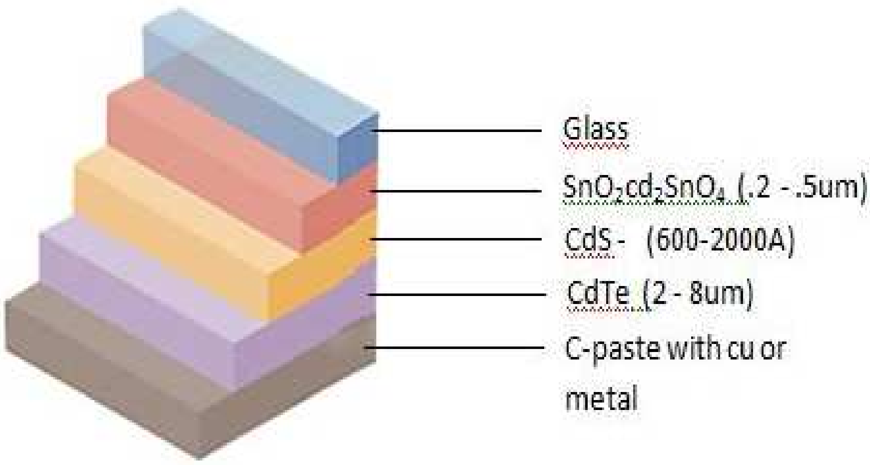

Figure 3.BasicStructure of CdTe Based Solar Cell

WORKING

Semiconductors are the fundamental materials of a photovoltaic cell. In the old day, solar panel technology was based on the silicon semiconductor to generate p-type and n-type layers, which resulted in several drawbacks. That is the point where the need of the Thin Film Layer technology arises. The silicon semiconductor materials are then substituted by either cadmium telluride (CdTe) or copper indium gallium deselenide (CIGS). In the CdTe solar cell the CdTe is used as the p-type semiconductor of the diode and CdS acts as the n-type layer for the cell. These n type and p type materials jointly form a Photo voltaic cell. During the deficiency of light, a very tiny amount of atoms get excited and move across the junction. This produces a small voltage drop across the junction. In the sufficient amount of light, more atoms are excited and flow through the junction and results in a large current at the output. This current can be reserved in a rechargeable battery and can be used for various use according to our need.

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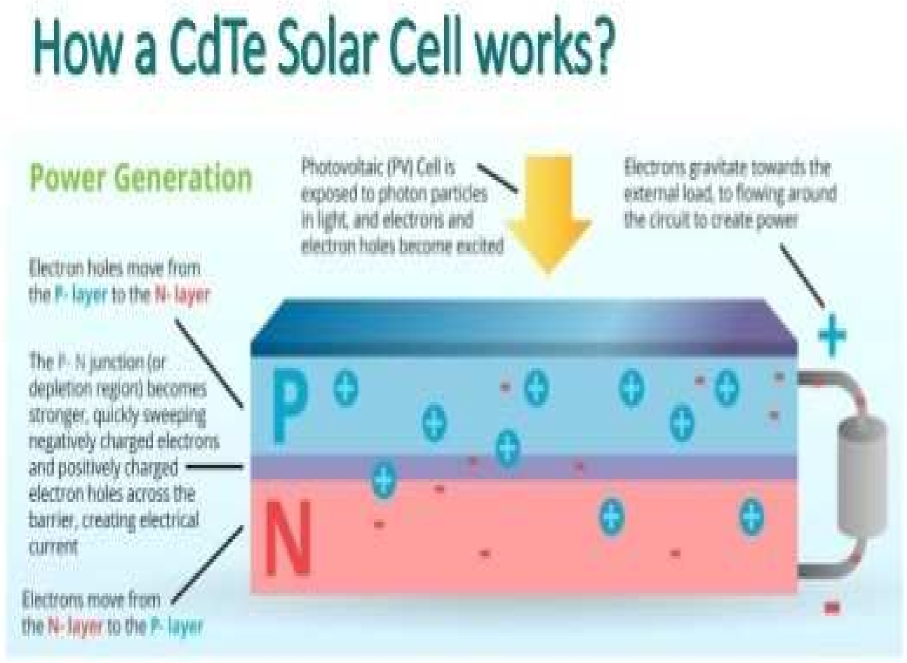

Figure 4.How a CdTe Solar Cell Works

FABRICATION

As earlier discussed , the band gap value (1.45 eV) of CdTe is very near to the ideal band gap value(1.5 eV), has placed CdTe in the queue as one of the best substance for fabricating the high efficiency solar cell. It was efficient to provide both the p-type and n-type layers, initially research stimulated the homojunction CdTe devices. Due to several disadvantages which practically could not be implemented. Later on the homojunction with p+/n/n+ structure made a conversion efficiency of 10.7%. When the CdTe/CdS appeared it became most promising because of the energy band which is having an excellent discontinuous p-n heterojunction. There are various procedures layering out a broad field of technologies from the wet chemical techniques just like electrode position, to more typical semiconductor processing operations such as vaccum evaporation.

Now we will be going through some of the deposition techniques will be now studied

ELECTRODEPOSITION

The very first efficient electroplated CdTe/Cds heterojunction solar cell was designed by an ultra-thin (0.05-0.1um) CdS layer deposited over the ITO/glass substrate to permit optimization of the incoming solar spectra. The main step in fabrication process of high efficiency electrodeposited CdTe/CdS solar cell is the ‘Type Conversion Junction Formation’ (TCJF) procedure which includes heating the as-deposited CdTe layers in air. This process is done by keeping the temperature around 400°C. The annealing step basically converts the actual n-type CdTe films into high resistivity p-type. Right because of this a rectifying junction is produced between the CdTe layer and the thin CdS film. The electro depodition layer of CdTe layer has also made possible the fabrication of high efficiency ZnTe/CdTe/CdS devices.

SCREEN PRINTING

In this method a paste is made of a mixture of 91 wt% CdS powder, 9 wt% CdCl2 and an

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appropriate amount of propylene glycol. Then this mixture is first screen prited. This is done on a borosilicate glass substrate. After drying, the film is sintered at 690°C for 90 minutes in a N_2 atmosphere. The key step in screen printing technique is the sintering process that forms CdTe films. The annealing processes for the screen printed CdTe films are carried out in N_2 atmosphere.

CLOSE SPACED SUBLIMATION (CSS)

In this approach of fabrication, first a CdS film(0.1um), then a CdTe layer (4.0um) were deposited on an ITO couted glass plate at substrate temperatures of 550°C and 600°C, respectively. Hot pressed polycrystalline discs of CdS and CdTe were used as the source materials.

SPRAYING

This type of fabrication is done with an aqueous solution of CdCl2 and thiourea. It was first sprayed onto a heated (300°C-350°C) ITO/glass substrate which resulted in formiation of a thin CdS layer. A CdTe film was then grown over the CdS layer by spraying a solution containing Cd and Te species.

PROMOTION IN FABRICATION TECHNIQUES

There are two main goals in fabricating solar cell. High efficiency and low price. Fabrication methods for CdS/CdTe layers could result in a significant consequence on cell efficiency and cost. We have already discussed several common techniques of CdTe thin-film formation. However, these methods arestillnot enough proficient due to their deep-rooted drawbacks. Therefore, the procedures should be precisely selected with the consideration of 1) high transcendence of thin-film structure (high efficiency), 2) perfect pollution control, 3) commercial production prospect. Prospitiously, several moderations to conventional methods and different new techniques have been explored to improve the problem in that old technique of Fabrication.

SPUTTERING IN AR + CHF3 ATMOSPHERE

One outstanding modification to the fabrication of CdS layers is using R.F. sputtering in the atmosphere of argon (Ar) containing ∼3% of CHF3. This gas is decomposed and ionized during the sputtering discharge, delivering electronegative fluorine (F) to the substrate. Although it has been proved that F does not reduce the resistance of CdSlayers compared with undoped CdS, F-doped CdS still exhibits a larger forbidden gap, a stronger photo conductivity, and, most importantly, gives higher-efficiency solar cells.

BILAYER CDS THIN-FILM PREPARATION

In this technology, the first CdS layer is made by standard CBD process with reduced time and then the second CdSlayer is deposited by CBD at lower temperature (55C).Approximately 14.6 nm’s roughness was observed in atomic force microscopy (AFM) for standard CBD of CdS thin film, while it could be reduced to 7.2 nm in bilayer case. Then smaller grain size would be obtained since the bilayer structure could provide the compact and uniform CdS layers without pinhole sand cracks among grain boundaries. Moreover, thinner CdS film results in higher short-circuit current and improved the efficiency by around 6.1% with less demand of material.

LOW- TEMPERATURE DEPOSITION METHOD

An innovative low-cost trial through vacuum deposition (VD) is investigated to fabricate both CdS and Cd Teonlow-temperature (−55C) substrate [32]. The substrate holder cooled by liquid nitrogen, while a secondary heater can adjust the temperature in a desired range. This

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process could provide higher optical transparency of CdS thin film and similar grain size (average 300 nm) for both layers.

ALL-ELECTRODEPOSITED METHOD

In the all-electrical-deposition (AE) processing for CdS thin film, agraphiteanode and glass/fluorine-doped tin oxide (FTO) cathode are applied to pass an electric current through the electrolyte with CdCl2and Na2S2O3 dissolved in (pH = 1.40) .

DRY CDCL2 TREATMENT FOR CDTE RECRYSTALLIZATION

Conventionally, CdS/ CdTe samples are immersed into the solution containing CdCl2 and heated at 400–500C in order to enlarge the grains inside the CdTe layers and eliminate defects to increase the minority carrier lifetime. However, it seems to be unsuitable for large area manufacture considering industrial production and the residue of the solute may not be thoroughly cleared up. To solve this, the dry $CdCl_2$ treatment by physical vapor deposition (PVD) on the sputtered CdTe layer. This method reveals effective process since no vacuum breaks are involved in production line, which agrees with commercial prospects.

NONTOXIC CHLORINE AMBIENT TREATMENT

As the heat treatment with CdCl2 would bring both pollutions to environment and toxic threats to operators, nontoxic process is expected to be explored while retaining the efficiency of solar cells. a solution: to anneal the CdS/CdTe structure in mixture of 100–500 mbar of Ar and 20-50 mbar of non-toxic gas containing Cl_2 such as difluorochloromethane (HCF2Cl) for 5-10 minutes at 400 C.HCF_2Cl is stable, inert, and nontoxic at room temperature, and it would be decomposed as $Cl_2$and other products during annealing. The merits of this method are that it provides an effective way of producing high-quality CdTe layers with large grains and few defects.

COMPARISON BETWEEN CdTe THIN-FILM AND TRADITIONAL SILICON BASED SOLAR CELLS

UNDERLYING PHYSIC

Traditional solar cells use silicon in the n-type and p-type layers. In the presence of light, photons knock over a large number of electrons, which flow across the hetero junction to create a current. CdTe film acts as the primary photo conversion layer and absorbs most visible light within the first micron of material.

The CdTel, intermediate, and TCO layers, together, form an electric field that converts light absorbed in the CdTel layer into current and voltage.

BAND-GAP

As we know the optimum band gap for a layer to have optimums and Voc is between 1.4-1.6 eV but energy gap of silicon solar cells are 1.1ev whichis lower than CdTe Thin-Film (1.45).

EFFICIENCY

cSican be put to have higher efficiency, using tandem (multi) Junctions, double lines. The typical efficiency still range from 17(poly) to 21% (mono). CdTel efficiencies are not particularly tunable, they peak around 20% in lab conditions. Impact of temperature and humidity is particularly deleterious on conversion efficiency in CdTel cells and line efficiency of ~11% is about the norm.

MARKETING

First generation solar cells accounted for 80% of commercial production compared to Thin-Film

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solar cells (second generation solar cells), though the market share of these solar cells are declining.

COST

The traditional silicon technique requires expensive manufacturing technologies where as thin-film solar cells have Lower manufacturing costs.

REQUIRED MASS

In thin films the mass is compatibly reduced than that of silicon solar cells.

PLACING

In CdTe/CdS Less support is needed when placing panels on rooftops.

TOXICITY

Silicon cells are non toxic and is abundant compared toCdTe cells.

ADVANTAGES

HIGH ABSORPTION

Cadmium telluride is a direct-band gap material having a band gap energy of about 1.45 defined (eV), which is well matched to the solar spectrum and nearly optimal for converting sunlight into electricity using a single junction. It has higher cell conversion efficiency-with a 21% record set by First Solar-as compared to amorphous silicon (a-Si).

LOW COST MANUFACTURING

Cadmium telluride solar cells use low-cost manufacturing technology to produce low-cost cells. Due to production costs that are far below those of silicon based solar modules, CdTe solar cells are currently one of the mostly employed thin film types and rank only second to crystalline silicon panels.

REUSE OF WASTAGE

Cadmium-as a waste and by-product in the mining industry-is a very abundant resource and thus less prone to price fluctuations.

HOT CLIMATE ADVANTAGES

CdTe modules have a better temperature co-efficient than typical silicon modules. This means that in tropical, equatorial or desert climates where module temperatures can reach 60-70 celsius, CdTe modules can reach up to 90% of their peak output, where silicon modules may be reaching only 80% or less of their peak rated output. This leads to increased overall yield for a given installation size, and explains why CdTe has gained extremely positive feedback and a high market share in major solar markets such as India and Thailand

CLOUD/HAZE ADVANTAGE

CdTe modules have a wider collection bandwidth across the light spectrum than silicon, so on cloudy or hazy conditions will perform closer to their peak rated output.

DISADVANTAGES

RARITY OF TELLURIUM

The extreme rarity of tellurium is another obstacle in the applications of this cadmium-tellurium compound. Tellurium is counted among the rarest material found in earth’s crust. This fact limits the number of panels made each year using this material.

TOXICILOGY

Cadmium is considered to be one of the six most toxic materials know to humans. It is the main cause for the toxicity of Cadmium Telluride. The high toxicity level of Cadmium Telluride is another disadvantage of applying it many purposes. According to one study, the high reactivity of this substance triggers oxygen

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damage to living cell membrane, nucleus and mitochondria. The Cadmium Telluride films typically re-crystallize into toxic cadmium chloride solution. However, this compound is much less toxic than cadmium metal.

PRESENT WORKS GOING ON

The research on CdS/CdTe solar cell is the most striking topic in the present Globe for the evolution of cheap and efficient solar panel for the transformation of solar energy into electrical energy. The main constituent in the CdTe development project is the "CdCl2 Treatment" which includes the growth and post-growth treatment of the layers of CdCl 2 in the existence of CdCl2 or Halogens like Chlorine and Fluorine. This heat treatment is conducted in the temperature range of 350 degree C-450 degree C around 60-20 minutes time in normal atmospheric conditions which exponentially increases the efficiency of solar cell from 1%-5% to binary digits for Cadmium Chloride treated materials. For understanding the practical reason behind this increasing efficiency a huge investigation and experiment is done but hardly any target could be reached. If anyone can properly penetrate into this processing step then the working of the solar cell can be improved more and the motionless efficiency of the solar ce3ll from the past two centuries can be removed. The different procedures that are undertaken for the treatment of CdCl2 solar cell are Vacuum evaporation, Sputtering, Close space sublimation, Electro-deposition and Screen Printing. The transparent conducting oxides (TCO) used are Indium Tin Oxide (ITO) and Fluorine-doped Tin Oxide (FTO). The width of CdTe layer varies from 200-400 nm with high transparency and low resistance of 7-15 ohm/sheet. The normal procedure of the treatment of CdCl2 is to open out a saturated solution of CdCl2 in water or methanol on the uppermost part of CdTe and permit the solvent to vaporize and heat treat the material at elevated temperature of 450 degree C for a fixed duration of time in air and CdCl2 powder will be distinctly noticed on the surface of CdCl2 and other have optionally done the same thing by the method of vacuum evaporation and laser ablation. In the short time ago Freon gas (HCClF2) is used for post-growth treatment ofCdTe solar cell by means of Vacuum evaporation process. In the above mentioned method Halogen specially Cl and F molecules are present in CdTe/gas interface in the time of heat treatment of CdTe layer at elevated temperatures of 650 degree C. This increases the efficiency of solar cell upto 16%.

FUTURE SCOPE

With time the change in the climate is becoming a major threat to the future of the human life and for all other life on the earth. And if we want to reduce the adverse effects of climate change we have to reduce the emission of greenhouse gases (GHG) by 80% till 2050 and for that the deployment of low carbon energy technologies at a massive scale is required urgently. Solar power systems. Installation of solar panels helps to combat greenhouse gas emission and reduces fossil fuel dependence. The use of solar energy is accepted by the world not only as a step towards a better future but also as a great investment. The investment made on solar energy increases the property value if we decide or plan to sell the after few years. Lawrence Berkeley National Laboratory in California made a study and it was found that buyers were ready to pay $15,000 more if the home was installed with an average sized panel solar system, which may help one to get more than the original investment.

The future of the energy will be renewable and clean is solar energy is completely accepted in every place of the world. In the year 2016 solar energies made the maximum addition to the year's power grid. About 93% of the total 26 giga watts of utility scale generating capacity

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was made by renewable energies i.e, solar, natural gas and wind energy. The U.S raised to be in the number four position of the maximum usage of the power. China, Germany7 and Japan are still ahead of the U.S in cumulative solar capacity.

Table 1.San diego metro area paired sales premiums and contributory value estimates

Paired Sale	ST	Location	Total PV Premium	Sales Price Premium ($/Watt)	Gross Cost ($/Watt)	Net Cost ($/Watt)	Low Income Estimate ($/Watt)	Average Income Estimate ($/Watt)	High Income Estimate ($/Watt)	Sale Price of Solar House	Premium as a % of Sale Price
1	CA	Chula Vista	$20,700	$5.05	$6.11	$4.14	$3.61	$3.89	$4.20	$400,000	5.18%
2	CA	Chula Vista	$11,000	$3.67	$6.37	$4.32	$3.62	$3.91	$4.23	$836,000	1.32%
3	CA	El Cajon	$16,800	$3.72	$6.11	$4.14	$3.61	$3.90	$4.22	$575,000	2.92%
4	CA	LaJolla	$15,000	$3.21	$5.63	$3.80	$2.17	$2.30	$2.43	$1,050,000	1.43%
5	CA	San Diego	$5,850	$4.09	$6.37	$4.32	$2.06	$2.18	$2.31	$675,000	0.87%
6	CA	San Diego	$30,850	$6.02	$6.37	$4.32	$2.95	$3.14	$3.36	$499,000	6.18%
7	CA	San Diego	$52,500	$7.53	$6.37	$4.32	$4.07	$4.40	$4.78	$500,000	10.50%
8	CA	San Diego	$16,580	$6.09	$6.11	$3.77	$3.72	$4.02	$4.34	$535,000	3.10%
9	CA	Chula Vista	$5,000	$2.46	$5.59	$3.77	$3.95	$4.28	$4.65	$455,000	1.10%
10	CA	El Cajon	$5,000	$1.46	$5.59	$3.77	$3.31	$3.56	$3.82	$475,000	1.05%
11	CA	El Cajon	$11,970	$5.70	$5.59	$3.77	$4.02	$4.37	$4.75	$500,000	2.39%
12	CA	Alpine	$14,500	$2.80	$5.63	$3.80	$4.08	$4.42	$4.80	$436,500	3.32%
13	CA	Lemon Grove	$16,900	$4.27	$5.59	$3.77	$3.14	$3.38	$3.64	$379,000	4.46%
Mean			**$17,127**	**$4.31**	**$5.96**	**$4.00**	**$3.41**	**$3.67**	**$3.96**	**$562,731**	**3.37%**
Median			**$15,000**	**$4.09**	**$6.11**	**$3.80**	**$3.61**	**$3.90**	**$4.22**	**$500,000**	**2.92%**

The future of the energy will be renewable and clean is solar energy is completely accepted in every place of the world. In the year 2016 solar energies made the maximum addition to the year's power grid. About 93% of the total 26 gigawatts of utility scale generating capacity was made by renewable energies i.e, solar, natural gas and wind energy.

Table 2.San diego metro area PV information, days on marketing, Electric rates, and escalation rates

Paired Sale	Total PV Premium	Size System (kW)	Age System (yrs)	Sale Date	Solar PV Sale-Days on Market	Non Solar Days on Market	Electric Cost ($/kWh)	Est. Yrly Electric Escalation Rate (%)
1	$20,700	4.10	3.6	8/31/2012	10	113	$0.1637	2.89%
2	$11,000	2.99	2.2	4/3/2012	30	7	$0.1637	2.89%
3	$16,800	4.52	2.5	7/21/2012	9	10	$0.1637	2.89%
4	$15,000	4.67	11.41	11/16/2012	50	56	$0.1670	4.24%
5	$5,850	1.43	10.58	4/17/2012	35	8	$0.1637	2.93%
6	$30,850	5.12	7.12	5/24/2012	77	2	$0.1637	2.93%
7	$52,500	6.30	1.2	6/26/2012	18	21	$0.1637	2.93%
8	$16,580	2.72	2.5	6/15/2012	24	35	$0.1637	2.93%
9	$5,000	2.03	1.67	5/13/2013	4	5	$0.1670	2.85%
10	$5,000	3.42	4.75	4/20/2013	10	7	$0.1670	2.82%
11	$11,970	2.10	0.5	5/11/2013	21	9	$0.1670	2.85%
12	$14,500	5.17	1.25	2/11/2013	14	9	$0.1670	2.85%
13	$16,900	3.96	5.33	5/20/2013	22	4	$0.1700	2.80%
Mean	**$17,127**	**3.73**	**4.20**	**10/21/2012**	**25**	**22**	**$0.1655**	**2.98%**
Median	**$15,000**	**3.96**	**2.50**	**8/31/2012**	**21**	**9**	**$0.1637**	**2.89%**

The U.S raised to be in the number four position of the maximum usage of the power. China, Germany7 and Japan are still ahead of the U.S in cumulative solar capacity.

CONCLUSION

The underlying conclusion that can be drawn from this review paper is that the CdS/CdTe thin film solar cell is regarded as another polycrystalline structure with abundant experimental data associated with the manufacture of the photo-voltaic panel. It is sketched for the transformation of solar energy into electrical energy. It is the only technology with little carbon footprint, lowest water use and very short energy payback time of all solar technologies.

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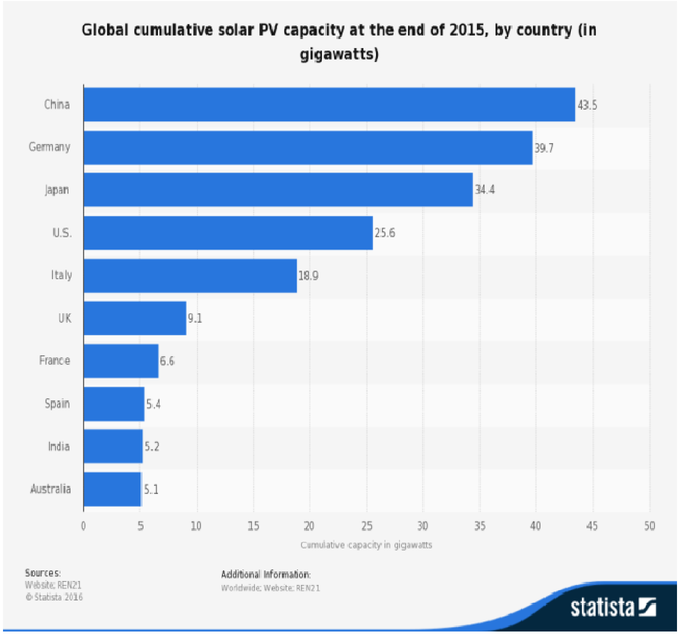

Figure 5.Global cumulative Solar pv Capacity

The solar cell has the advantage that it can easily be manufactured and it absorbs .sunlight which is close to the ideal wavelength that is capturing shorter wavelengths than silicon panels and Cadmium is also abundant. But the disadvantage is it has comparatively low efficiency and though Cadmium is abundant, Telluride is present in very small amount. Moreover Cadmium is deadly toxic in nature. So the disposal of Cadmium becomes difficult. But researches are going on for further for boosting the efficiency of the cell and also studying the technologies such as Grain boundaries that limits the voltage of the cell. Also different modules are designed that minimize the outdoor exposure to moisture. Inspite of huge amount of fantastic works and research undertaken there is still significant amount of work left in the field of CdS/CdTe solar cell.

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