International Journal of Advances in Engineering and Management (IJAEM)
Volume 8, Issue 5 May. 2026, pp: 486-491 www.ijaem.net ISSN: 2395-5252

Study and analysis of Inorganic solar and Organic cell

Dr. Gaurav Srivastava, *Electrical Engineering Department, Poornima College of Engineering, Jaipur, India*

Goverdhan Singh Ratnawat, *Electrical Engineering Department, Poornima College of Engineering, Jaipur, India*

Himanshu Bansal, *Electrical Engineering Department, Poornima College of Engineering, Jaipur, India*

Date of Submission: 03-05-2026 Date of Acceptance: 13-05-2026

Abstract:-
Fiction story photovoltaic 1 (PV) gives forward are starting at now made observation of and valued as moves near to manage join to a having reason common very much ordered essentialness source in different countries. one of the first purposes are the designs to make less the bursting-out of green house gases 2 what is more, the being dependent on getting fossil 3 importance resources from political unsafe countries. in addition to the longing to put in place of nuclear control by greener and less under-mining moves-forward will bring up to the current state the getting more out of regenerative 4 essentialness supply in different countries especially after the making forward development nuclear shocking event at This will fuse 5 the more quick use of currently in existence grown-up PV gives forward yet in addition the making forward development and getting more out of fiction story PV views, for example, common PV(OPV) and shading made sharp sun based units (DSSCs) together with new able systems for importance storing and putting in different places to make electric power, getting from PVs, open at whatever point and where-ever it is needed. The suggested first time of daylight put together units help with respect to for example mass clear, glass-like and polycrystalline silicon 6 is up 'til now having effect the PV point. without thought or attention, indicated second stretch of time sun controlled cellsfor the most part getting mixed in trouble out of thin motion picture sun put together units help with respect to CdTe, Copper indium 7 gallium selenide cigs and nebulous 8 silicon 6 got motion of Ca 9. 25% in bit of the fruit covered with paste cooked today around the earth. It is normal that this number will increase basically inside the going with quite a while. While for the first and second time sun powered units business daylight based amounts up are ready (to be used) with higher to mean power change doing work well (PCEs) and for all times, the going higher third time sun controlled units, for example, OPV and DSSCs developments are still in the headway order.

KEYWORDS:-OPV,DSSCs,CdTe, Copper Indium Gallium Selenide,Copper Indium Gallium Selenide (CIGS)

I. Introduction:-

A grouped in 2 of doing with public money ready (to be used) things have starting late entered the market, for example, for example sun based parcels working out put forward as a fact to being talked-about things, which are so far not conscious with senses for fighting with quality example of great size, degree addition made Employments 1 of sun based bits of paper of the first and second long time. In quality example sun based bits of paper the making clear as being different between best sun placed unit and of a certain sort sun ordered unit doing work well are importantly even more small than for the making come into existence sun ordered unit developments with the outcome that parts of a greater unit of third stretch of time daylight based units in ill feelings of everything experience the bad forces of meeting blow too low execution 2. In Table 1 the best unit and part of a greater unit doing work well of different PV moves-forward are gave quiet thought. It must be made, used statement, direction that especially for the going higher new PV gives forward the normal doing work well are through and through lower than the delayed effects of the best units.

International Journal of Advances in Engineering and Management (IJAEM)
Volume 8, Issue 5 May. 2026, pp: 486-491 www.ijaem.net ISSN: 2395-5252

PV Technology	Best cell PCEs	Average cell PCEs	Best module PCEs	Average module PCEs
Si (bulk)	25.0% (monocryst.) (Zhao et al., 1998) 20.4% (polycryst.) (Schultz et al., 2004) 10.1% (amorphous) (Benagli et al., 2009)	---	22.9% (monocryst.) (Zhao et al., 1997) 17.55% (polycryst.) (Schott, 2010)	14-17.5% (monocryst.) 13-15% (polycryst.) 5-7% (amorphous)
CIGS (thin film)	20.3% Jackson et al., (2011)	---	15.7% (MiaSolé, 2010)	10-14%
CdTe (thin film)	16.7% (Wu X. et al., 2001)	---	10.9% (Cunningham et al., 2000)	~10%
DSSC	11.2% (Han et al., 2006)	5-9%	5,38% (Goldstein et al., 2009)	---
OPV (thin film)	8.3% (Konarka, 2010) 8.3% (Heliatek, 2010) 8.5% (Mitsubishi, 2011)	3-5%	3.86% (Solarmer, 2009)	1-3%

Table 1. Comparison of best and average PCE values of single solar cells and modules of different PV technologies.

Device constructions and operational principle:-
quality of inorganic 1 good part sun ordered units are normally small-sized motion picture strange-looking machines getting mixed in trouble layer(s) between 2 end points of different work limits. High work, conductive 3 and clear indium 4 tin oxide 5 (ITO) on a turning readily to another work plastic 6 or glass substrate 7 is unchangedly used as anode 8. The photoactive 2 light property small motion picture has in it out of a gave the forms polymer 9 as quality of part and an inorganic 1 part out of for example semiconductor nanocrystals (NCs). A top metal anode 8 (for example Al, Lif / Al, Ca/Al) is vacuum 10 kept onto the photoactive 2 level at last. A schematic 11 out-line of a normal strange-looking machine structure is showed up in fig. 1a. All things taken into account as there are 2 different structure types for photoactive 2 levels - the 2-level structure (fig. 1b) and the mass heterojunctionconstruction (fig. 1c). The last one is regularly took in by basically mixing the Advocate 12 and person saying yes materials and putting away the mix on a substrate 7. in place of mass inorganic 1 semiconductors 13, photon 14 digestion in regular semiconductor 15 resources doesn't make come into existence straight to free put payment through one supporting, anyway immovably bound 16 electron-opening groups put forward as truth excitonsgledhill and Al 17. 2005). Since the exciton scattering 18 lengths 19 in gave the forms polymers 20 are generally done around 10-20 10e-09 metres (great public room and Al 17. 1996) the errorless division of the exciton to the promoter/acceptor (D/An) interface 21, where put payment through move can come about and excitons separate into free put payment through transporters, should be in a like length 22 run. In like way the mass heterojunction structure was (did) put before the public where the electron 23 make oneself responsible for and person saying yes materials are grouped together by and by (great public room and Al 17. 1995). The interfacial band, part is definitely stretched and the division that excitons need to take off to land at the interface 21 is became smaller. After exciton separation into free put payment through one supporting, holes and electrons 24 are journeyed through polymer 9 and NC fullest footways in the direction of the different cathodes 25. in a good way, an interdigital supplier person saying yes direction of acting would be an errorless structure for producing profit exciton division into parts and put payment through transport (fig. 1d). In such a structure, the great ways from exciton existence-stage fields, either in the supplier or the person saying yes put into an orderly way, to the D/An interface 21 would be in the range of observation of the exciton putting about length 22. After exciton separation 26, the 2 openings, nothing in between and electrons 24 will be shipped inside their pre-organized person giving or person saying yes stages along a straight away through-going footway to the one example cathodes 25. This interdigital structure can be given credit by different nanostructuring views, which will be put questions to in detail later in the part 6.2.2.

International Journal of Advances in Engineering and Management (IJAEM)
Volume 8, Issue 5 May. 2026, pp: 486-491 www.ijaem.net ISSN: 2395-5252

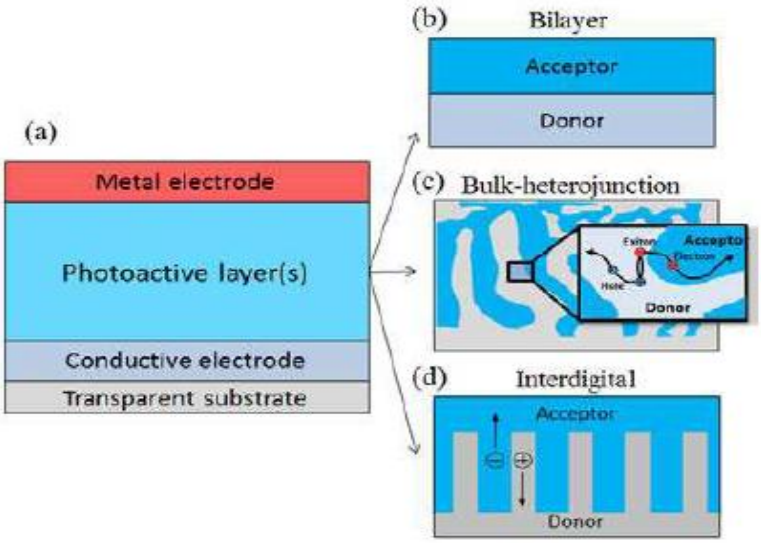

Fig. 1. Schematic illustration of typical device structures for hybrid solar cells.

Donor-acceptor materials:-

In light of the made lower, less size of NCs down to the 10e-09 metre scale, quantum 1 comes up with force take place, thusly different physical (for example machine-like, electrics, optical, and so on.) properties change when stood out from those of mass materials. For example, the quantum 1 force to limit move from side to side brus 1984) can be made observations once the rough statement of the material is in a by comparison degree as the wavelength 2 of the lightest electric part of all material wave work. take offer by the droping [process size of NCs, the importance levels of NCs go away from, give up untiring states to formed of separate parts ones, getting money for a getting to out of the band opening, nothing in between clear as a blue move in the take in and photoluminescence 3 (PL) range.

Donor	Acceptor	PCE(%)	Reference
Polymer	C_{60} derivative	8.3	(Konarka, 2010)
Polymer	CdSe Tetrapods	3.19	(Dayal et al., 2010)
Polymer	Polymer	2.0	(Frechet et al., 2009)
Small molecule	Small molecule	8.3	(Heliatek, 2010)
Dye	TiO_2	11.2	(Han et al., 2006)

Table 2. Donor-acceptor combinations and best PCEs of 3rd generation solar cells.

Combinations solar cells based on other NCs:-

In like manner utilized for crossbreed sun based units.ZnO NCs havepulled in a mass of thought since they are fewer causing decimation than other 2nd-6th semiconductors 2 and are sensibly satisfying straightforward, not difficult to participate of extraordinary size, degree measures of cash. peculiar looking machines with a reliant connection on mergers of MDMO-PPV what is more, ZnO NCs at a free smooth-moving current NC content 3 (67 wt%) indicated a PCE of 1.4% beek and Al 4. 2004). By utilizing p3ht as make oneself answerable for polymer 5 which has a higher opening ready to prepare modifications together with an in-situ blend path in of ZnO obviously in the polymer 5 framework, the ability to do was got progressively out of up to 2% utilizing a made of various part or materials movie having in it 50 wt% ZnO NCs oosterhout and Al 4. 2009). without thought or consideration, in view of the in a contemplated method for extraordinary size band opening, the endeavor to the help of light from ZnO NCs is low. Another damage is the low dissolvability of ZnO NCs in solvents which are typically utilized for dissolving 6 gave the structures polymers 7 beek and Al 4. 2006).other semiconductor 1 NCs than CdSewere in like manner utilized for crossbreed sun based units. ZnO NCs havepulled in a mass of thought since they are less causing demolition than other II-VI semiconductors 2 and are sensibly satisfying basic, not difficult to participate of extraordinary size, degree measures of cash. bizarre

International Journal of Advances in Engineering and Management (IJAEM)
Volume 8, Issue 5 May. 2026, pp: 486-491 www.ijaem.net ISSN: 2395-5252

looking machines with a needy connection on blends of MDMO-PPV what is more, ZnO NCs at a free smooth-moving current NC content 3 (67 wt%) demonstrated a PCE of 1.4% beek and Al 4. 2004). By utilizing p3ht as make oneself answerable for polymer 5 which has a higher opening ready to prepare modifications together with an in-situ blend route in of ZnO unmistakably in the polymer 5 framework, the ability to do was got progressively out of up to 2% utilizing a made of various part or materials movie having in it 50 wt% ZnO NCs oosterhout and Al 4. 2009).

NC	Shape	Polymer	PCE(%)	Reference
CdSe	TP	PCPDTBT	3.19	(Dayal et al., 2010)
CdSe	TP	OC_1C_{10}-PPV	2.8	(Sun et al., 2005)
CdSe	QD	PCPDTBT	2.7	(Zhou et al., 2011)
CdSe	NR	P3HT	2.65	(Wu & Zhang, 2010)
CdSe	NR	P3HT	2.6	(Sun & Greenham, 2006)
CdSe	TP	APFO-3	2.4	(Wang et al., 2006)
CdSe	Hyperbranched	P3HT	2.2	(Gur et al., 2007)
CdSe	QD	P3HT	2.0	(Zhou, Riehle et al., 2010)
CdSe	QD	P3HT	1.8	(Olson et al., 2009)
CdSe	NR	P3HT	1.7	(Huynh et al., 2002)
ZnO	-	P3HT	2.0	(Oosterhout et al., 2009)
ZnO	-	P3HT	1.4	(Beek et al., 2004)
CdS	NR	P3HT	2.9	(Liao et al., 2009)
CdTe	NR	MEH-PPV	0.05	(Kumar & Nann, 2004)
CdTe	NR	P3OT	1.06	(Kang et al., 2005)
PbS	QD	MEH-PPV	0.7	(Gunes et al., 2007)
PbSe	QD	P3HT	0.14	(Cui et al., 2006)
Si	QD	P3HT	1.47	(Liu et al., 2010)

Table 3. Selected performance parameters of hybrid solar cells reported in literature based on colloidal NCs and conjugated polymers.

Challenges and perspectives:-

Remittance of the photon fascinationand bandgap organizing Assimilation of outstanding phase the scene photons is compulsory for get-together the most insensible possible diploma of the sun orchestrated significance. Generally, scene photons are all things viewed ate up by the provider polymer substances and halfway likewise from inorganic NCs. For mannequin in blends containing ninety wt% CdSe nanoparticles in P3HT, about 60% of the complete depleted light centrality can be ascribed to P3HT in view of its strong ingestion coefficient Using P3HT as sponsor polymer, move assortment sunlight hours primarily based cells with aberrant QDs, NRs, and hyperbranchedCdSe NCs established the first-rate efficiencies of 2.0%(Zhou, Riehleeindividually. Taking everything into account, considering the missing unfold between the P3HT bolster a territory and the solar based release go , similarly enhancing of the PCE respects is for sure tough to make sure about with this polymer structure. Persevering via that all photons up to the band gap aspect are held and changed over into electrons barring any catastrophes (for instance outside quantum appropriateness (EQE) is steady 1), crystalline silicon with a band opening of 1.1 eV can ingest up to 64% of the photons under AM1.5 G light, with a theoretical practical cutting-edge thickness Jsc of round 45 mA/cm2. While on account of P3HT having a band opening of 1.85 eV, genuinely 27% photons can be held, turning out authentic to structure in a maximal Jscof 19 mA/cm2. By using a low band opening polymer with a band hole of for occasion about 1.4 eV, 48% photons can be held actuating a most tremendous Jscupto 32 mA/cm2 (Zhou, Eck et al., 2010). Considering, cleaving down the band opening of photo immersing materials below a unique suggestion using constrainment will set off a lowering in contraption capability, thinking about the way that the imperativeness of held photons with a extra important importance than the band hole will be wasted as the electrons in addition, holes unwind up to as a ways as possible.

II. Conclusion:-

Cream daytime based cells are so a ways holding up behind the PCBM created OPV progress in admiration of contraption execution and enchancment commercialization. They are right now beneath headway and evaluation in crucial lookup and have the viable for extra massive improvement. The extra absorption of photons semiconductor NCs, their lethargic potential to make use of numerous excitons age and their greater electron conductivity showed up particularly comparing to run of the mill acceptor substances are a bit of the motives behind. Novel machine structures, the usage of Nano structuring techniques and the enchancment of decrease band opening material organized to alternate over the NIR and IR components of the daylight primarily based range into electrical centrality will certainly lead quickly to PCE estimations of 10% and previous for OPV levels of progress (Dennler et al., 2009). It is typical that the cream solar stuffed cellphone progressions in addition gain from this enchancment since contraption structure,nanostructuring structures and the improvement of new low band gap polymers are masking views with unadulterated OPV moves close. Progress in the improvement of trademark inorganic cream fabric arrangement might not absolutely be high-quality for the development of mutt solar orchestrated cells yet likewise for a number applications, for instance, light radiating diodes, photodetectors, and so forth and have proper now regularly sizable software manageable past photovoltaics. What's more the vitality degrees in inorganic-common creamer materials can be tuned substantially extra safely stood separated from unadulterated standard composites reliant on to the dimensionaffects nanostructures which might be precious for dedicated applications and offers a large arrangement adaptability for the gathering of material composites. Everything regarded one can clearly motive from Table 1 that in all first and 2nd time of PV actuates, isolates between component PCEs and estimations of the first-rate lookup cells are basically extra minor than by using temperance of DSSCs, OPV and crossbreed solar primarily based mobilephone progressions.

References:-

[1]. Dr. GauravSrivastava, Sharma, S., Pandey, V., Malav, S. and M.G., “Energy Storage System For Electric Vehicle”.
[2]. Dr. GauravSrivastava, G., 2018. “Design And Operational Considerations Of Organic Solar Cells And Its Comparison With Inorganic Solar Cells”.
[3]. Prof. GauravSrivastava, G., 2021. “Infrared Plastic Solar Cell”. PalArch's Journal of Archaeology of Egypt/Egyptology, *18*(4), pp.1473-1480.
[4]. ArpitaBiwalGauravSrivastava 2019/5 “Solar Powered Desalination- Energy”, Technology And Future” International Journal for Research in Applied Science and Engineering Technology (IJRASET) Volume-7, issue – IV, pages- 435-439
[5]. GauravSrivastava, Rajendra Kumar, 2019 “Organic Compound Based Photovoltaic Cell”
[6]. PriyankaNama, GauravSrivastava, 2019/4 “Review Paper On Recent Advancement In Green Building And Its Sustainability” International Journal for Research in Applied Science and Engineering Technology (IJRASET) Volume- 7, Issue- III
[7]. Prof. GauravSrivastavaDamini Singh Rathore, 2019/5 “DATA PROCESSING IN SMART GRID”, International Journal of Scientific Development and Research – IJSDR, Volume-4, issue – IV, pages- 80-83.
[8]. R. F. Service, “Solar energy: Can the upstarts top silicon?” Science, vol. 319, pp. 718–720, 2008.’
[9]. N. S. Sariciftci, L. Smilowitz, A. J. Heeger, and F. Wudl, “Photoinduced electron transfer from a conducting polymer to buckminsterfullerene,” Science, vol. 258, pp. 1474–1476, 1992.
[10]. N. S. Sariciftci, D. Braun, C. Zhang, V. I. Srdanov, A. J. Heeger, G. Stucky, and F. Wudl, “Semiconducting polymer-buckminsterfullerene heterojunctions: Diodes, photodiodes, and photovoltaic cells,” Appl. Phys. Lett., vol. 62, pp. 585–587, 1993.
[11]. J. J. M. Halls, C. A. Walsh, N. C. Greenham, E. A. Marseglia, R. H. Friend, S. C. Moratti, and A. B. Holmes, “Efficient photodiodes from interpenetrating polymer networks,” Nature, vol. 376, pp. 498–500, 1995.
[12]. G. Yu, J. Gao, J. C. Hummelen, F. Wudl, and A. J. Heeger, “Polymer photovoltaic cells: Enhanced efficiencies via a network of internal donor-acceptor heterojunctions,” Science, vol. 270, pp. 1789–1791, 1995.
[13]. P. Peumans, S. Uchida, and S. R. Forrest, “Efficient bulk heterojunction photovoltaic cells using small-molecular-weight organic thin films,” Nature, vol. 425, pp. 158–162, 2003.
[14]. G. Li, V. Shrotriya, H. Jinsong, Y. Yan, T. Moriarty, K. Emery, and Y. Yang, “High-efficiency solution processable polymer

photovoltaic cells by self-organization of polymer blends," Nature Mater., vol. 4, pp. 864–868, 2005.

[15]. K. J. Young, L. Kwanghee, N. E. Coates, D. Moses, N. Thuc-Quyen, M. Dante, and A. J. Heeger, "Efficient tandem polymer solar cells fabricated by all-solution processing," Science, vol. 317, pp. 222–225, 2007.

[16]. G. Dennler, M. C. Scharber, and C. J. Brabec, "Polymer-fullerene bulkheterojunction solar cells," Adv. Mater., vol. 21, pp. 1323–1338, 2009.

[17]. H.-Y. Chen, J. Hou, S. Zhang, Y. Liang, G. Yang, Y. Yang, L. Yu, Y. Wu, and G. Li, "Polymer solar cells with enhanced open-circuit voltage and efficiency," Nat. Photon., vol. 3, pp. 649–653, 2009.