Study of Organic Solar Cell

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Abstract -- Organic solar cell is a type of photovoltaic solar cell. Organic solar cell is used organic semiconductor type material. Organic solar cell is represent a recent photovoltaic technology that convert sun light into electrical energy. Organic solar cell less energy consumption in manufacturing OSC than the Inorganic solar cells. Organic solar cell is the advance type of inorganic semiconductor. Compare to inorganic solar cell, organic solar cell is Mechanical flexible, low cost, light weight, thin film but the efficiency of organic cell is less then inorganic cell, by study increase the efficiency of organic solar cell. Most organic photovoltaic cells are polymer solar cells.

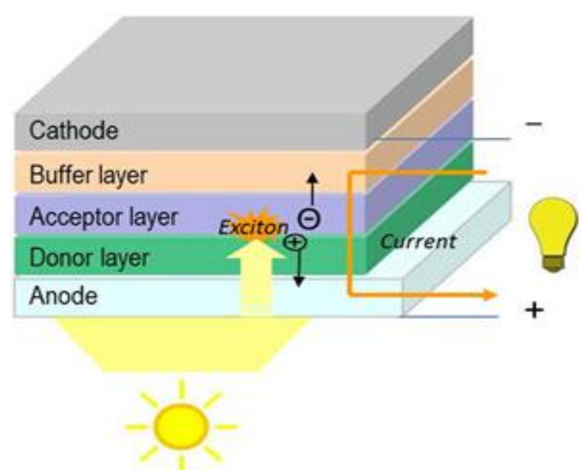
Index Terms -- Organic solar cell, pv cell, organic photovoltaic device, optical gap, efficiency.

I. INTRODUCTION

Solar energy is world fastest growing power generation technology. Organic solar cell is a type of photovoltaic solar cell. Organic solar. The low efficiencies of OPV cells are related to their small exaction diffusion lengths and low carrier motilities. These two characteristics ultimately result in the use of thin active layers that affect overall device performance. Organic photovoltaic solar cell provides a potential alternative replacement to conventional silicon technology owing to their superb characteristic compared to the former technology [1]. In addition, the unique quality and properties of organic cell is interesting mechanical flexibility. The molecules used in organic solar cells are solution-process able at high throughput and are cheap, resulting in low production costs to fabricate a large volume.[2] Combined with the flexibility of organic molecules, organic solar cells are potentially cost effective for photovoltaic applications. Molecular engineering (e.g. changing the length and functional group of polymers) can change the band gap, allowing for electronic tenability. Polymer-based organic solar cells are attractive in that they can be manufactured on plastic substrates by a variety of printing techniques and thus inexpensive large-volume manufacturing should be possible. In order to reach cost-effective, flexible and stable organic photovoltaic device, mechanical properties of package structure and materials should be concerned [2].

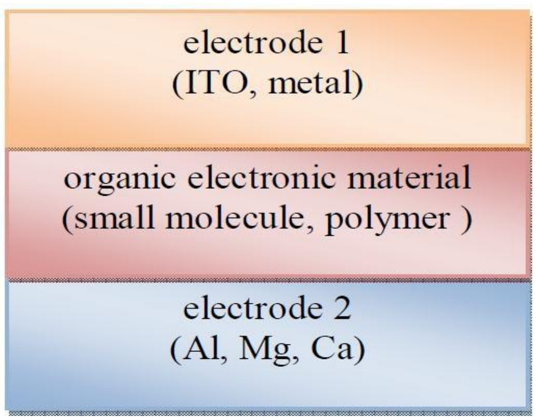
II. METHODOLOGIES

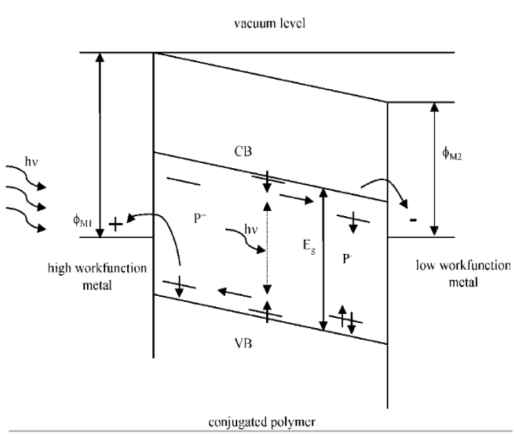
Organic photovoltaic (OPV) solar cells aim to provide an Earth-abundant and low-energy-production photovoltaic (PV) solution. This technology also has the theoretical potential to provide electricity at a lower cost than first- and second-generation solar technologies. Because various absorbers can be used to create colored or transparent OPV devices, this technology is particularly appealing to the building-integrated PV market. Organic photo voltaics have achieved efficiencies near 11%, but efficiency limitations as well as long-term reliability remain significant barriers.
Furthermore, the operational lifetime of OPV modules remains significantly lower than for inorganic devices.



III. SINGLE LAYER DIODES

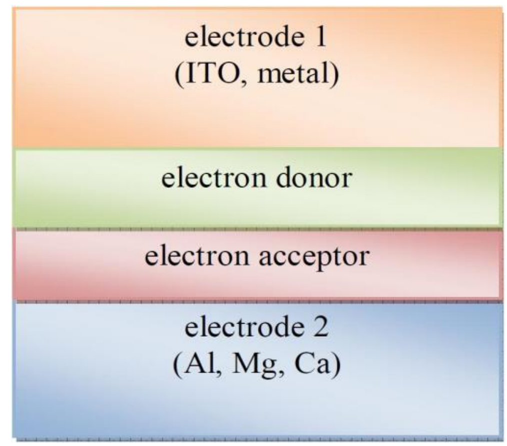
The most commonly implemented architecture in organic semiconductor devices is the single layer diode structure, which is characterized by a metal—insulator—metal tunnel diode with metal electrodes of asymmetrical work function, .Under forward bias, carriers are injected into a thin film of a single component organic semiconductor, with the electrons (holes) being transported from the metal of low (high) work function. Now, it is the case that at low voltages, reverse bias currents are far smaller than that of forward bias currents for a single carrier-type material. This is a direct result of the asymmetrical work function.





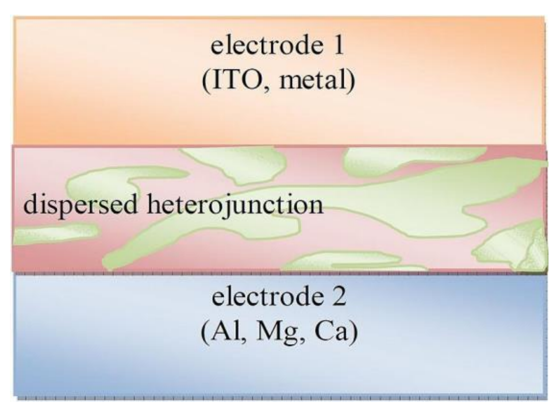
IV. BILEYAR DIODES

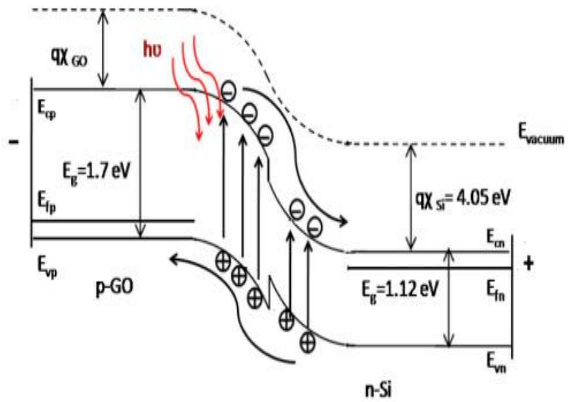
Bilayer cells contain two layers in between the conductive electrodes (Fig 3). The two layers have different electron affinity and ionization energies, therefore electrostatic forces are generated at the interface between the two layers. The materials are chosen to make the differences large enough that these local electric fields are strong, which splits exactions much more efficiently than single layer photovoltaic cells. The layer with higher electron affinity and ionization potential is the electron acceptor, and the other layer is the electron donor.



V. HETEROJUNCTION DIODES

Following the example scenario of a hetero junction formed between a conjugated polymer and C60 , laid out by Brabec, et al. (2001) , and considering the energy band diagram shown in Figure 2 (below) In the case of electron (hole) injection into the device on the semiconducting polymer side is energetically un favorable (favourable), leading to low (high) current densities. We therefore see—in direct analogy with a p-n junction —that devices of organic semiconductors utilising two layers with distinct electronic band structures exhibit rectifying diode characteristics. Photocurrents are generated at the interface due to photo-induced electron transfer, as well as initiating the photovoltaic effect.





VI. COMPARISON OF DIFFERENT TECHNOLOGY

In this section compare to organic material and inorganic material.

	Organic pv	Inorganic pv
Life time	10000 hours	10 years
Efficiency	5% to 11%	15% to 25%
Cost	Low	High
Transparency	Transparent	Opaque
Integration	easy	Not easy
Flexibility	flexible	Not flexible

VII. CONCLUSION AND FUTURE WORK

In this paper discuses future of solar cell is that organic solar cell . Solar energy is clearly part of the solution to the problem of dwindling fossil-fuel reserves. It's increasingly cheap; it's the target of huge quantities of investment and entrepreneurship, thanks to innovations like CSP (Concentrating Solar Power). But if you flinch at the idea of a world dominated by flat panels and vaguely sinister solar receiver towers, take heart: many designers are looking at the natural world for inspiration. Adapt to all surfaces and reduce production costs; these are the two main advantages of organic photovoltaic solar cells, a technology that could revolutionize the way we produce the energy we consume. Light, translucent and sensitive to low light levels, photovoltaic solar cells open a whole new range of possibilities which traditional solar cells cannot offer. The research work presented here several interesting and outstanding developments in the field of energy have occurred on the international front. Due to major influx of solar cell/panels from China and Japan the silicon photo voltaics sector has seen a price drop of almost 67% as compared to the year 2010, which has certainly strained the current research and development in this field. Therefore future developments in the field of energy (photovoltaic or PEC water splitting) should be based on the earth abundant and inexpensive materials with low processing cost in order to be able to survive in the cut-throat competition with the silicon technology. Recent outstanding advances in the field of organic-inorganic hybrid perovskite materials for energy applications have certainly boosted the hopes to develop energy solutions at very low cost as compared to silicon technology.

REFERENCES

[1] Mohd. Zuhir H., Ismail Saad, Roystone A., Khairul A.M, Bablu Ghosh, N. Bolong "AEnhancing Efficiency of Organic Solar Cells by Interfacial Materials Modification", Nano Engineering & Material (NEMs) Research Group, Faculty of Engineering, Universiti Malaysia Sabah, Jalan UMS, 88400, Kota Kinabalu, Sabah, Malaysia. 2017 IEEE

[2] Xing Chen1, 2, Simin Wang1, 2, Zhang Luo1, Shengzhi Zhang1, Zhicheng Lv2, 3, Hao Jiang1, Sheng Liu1, 2, "An Investigation on Structure and Materials of Laminated Organic Solar Cell Packaging", School of Optoelectronics Science and Engineering, Huazhong University of Science & Technology, Wuhan 430074, China 2012 IEEE

[3] Faysal Hakim, "Optimization and performance Analysis of PCBM Accepector based Bulk hetrojunction organic solar cell", Bangladesh University of Engineering and Technology, 2016 IEEE

[4] Bikram Kunwar, Ashish Singh, "Green Fluorescent Protein Chromophore Inspired Biodegradable Material for Ternary Active Layer Organic Solar Cell", Indian Institute of

Technology, Kanpur, Uttar Pradesh, 208016, India, 2016 IEEE

[5] Jinjoo Park,“ Advanced triple junction solar cell by employing inorganic-organic hybrid materials”,College of Information and Communication Engineering, Sungkyunkwan University, Suwon,440-746, Korea, 2016 IEEE

[6] Zi Shuai Wang, “Simulating Exciton Delocalization in Organic Solar Cells by a Modified Drift-Diffusion Model”, College of Information Science & Electronic Engineering, Zhejiang University, 2017 IEEE

[7] LORENZO TORTO1, “Model of Organic Solar Cell Photocurrent Including the Effect of Charge Accumulation at Interfaces and Non-Uniform Carrier Generation”, Risø National Laboratory for Sustainable Energy, Technical University of Denmark, 4000 Roskilde, Denmark, 2016 IEEE

[8] Hao-Jun Xie, Yan-Qing Li, Guo-Fu Ma, Qian-Kun Wang, Dan-Dan Zhang, and Jian-Xin Tang, “Enhanced Performance of Inverted Organic Solar Cells by Introducing a Phosphorescence-Doped Electron Extraction Layer” ,2015 IEEE

[9] Wenyan Wang, Ye Zhang , Ming Chen, Yuying Hao, Ting Ji, Furong Zhu, and Yanxia Cui, “Efficient light trapping in organic solar cell using a short-pitched hexagonal array of metallic nano cylinders” , 2016 IEEE

[10] Adam Raba, Yann Leroy, Markus Kohlstadt, “Organic Solar Cells: Extraction of Physical Parameters by Means of Markov Chain Monte Carlo Techniques”, IEEE

[11] Md Meganur Rhaman, “Organic Solar Cells: Historical Developments and Challenges”, Ahsanullah University of Science and Technology Dhaka, Bangladesh, 2015 IEEE International Conference.

[12] Khai Q. Le, Matthew Nixon, and Jing Bai, “Calibrated Dielectric Fiber Arrays for Light-Trapping Enhancement in Organic Solar Cells”, 2017 IEEE.

[13] A.V. Ermachikhin, A.D. Maslov, Yu. V. Vorobyov, V.V. Gudzev, T.A. Kholomina, “Investigation of Electophysical Characteristics of Organic Solar Cells based on P3HT:PEDOT Blend”, Department of micro- and nano electronics Ryazan, Russia, 2017 IEEE