Implementation of Low intensity Dye Sensitized Solar Cell for Electricity Generation

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Abstract. In advancement of technology, solar energy has become major source in producing electricity but in limited conditions. silicon based solar cells are good at generating electricity during day hours but it gives a drawback of producing electricity during low intensity light state. Implementing solar cells in wide range also comes out as a major challenge which has to be removed to meet energy crisis. This paper mainly focus on generating electricity using dye sensitized solar cell which gives a promising note of producing electricity in low intensity and implementing it in wide scale.

Keywords- solar cell; dye cell; renewable energy.

1. INTRODUCTION

Renewable energy is energy from a source which will not get depleted with time. It includes energy from wind, biomass, hydroelectric, geothermal and sun. At present energy from the solar cells plays an important part in producing energy which is renewable. Solar cell or photovoltaic cell is used to convert light energy to electrical energy. Using solar energy as renewable energy is a feasible and most widely used way of producing energy. Energy from sunlight is enough to give energy to mankind for whole year. Better use of sun’s energy is needed. In most of the application we use silicon solar panels for generating electric energy. Silicon solar panels act vulnerable during temperature fluctuations. It is ineffective in places where there is presence of low temperature. Michal Gratzel and Brian O’Regan invented Dssc in 1991, hence also named as Gratzel cells.
2. VIEW OF DYE SENSITIZED SOLAR CELLS

2.1 Transparent and conductive substrate.

DSSC’s contain two sheets of conductive transparent materials. To act as substrate it should possess two traits. This kind of solar cell are allowed 80% of light energy from sun to particular light and reduced maximum losses and improved efficiency compared with conventional solar cell. It should have increase in electrical conductivity. Most commonly used substrate type is FTO

2.2 Working Electrode

Oxide based semiconductor thin layer can be developed by this electrode. It also having ITO and FTO based small glass conducted plate.

2.3 Photo sensitizer:

Maximum Sun lights have absorbed by dye solar cell and it have below mentioned properties

- NIR and UIV spectra are absorbed by dye cell in that particular region
- Luminescence is one of the main property of solar dye cell.
- TiO2 Conduction band having maximum molecular orbital HOMO engaged.
- The minimum unengaged orbital molecular Lumo also having in TiO2 band.

2.4 Electrolyte:

Electrode is mainly consists of five components are I,I1,I3,Br1 and Br2. And also it having solvent, liquid and additives etc. The properties of electrolyte are given below

1. Oxidized dye generated by redox couple.
2. Electrolyte should have thermal and electrochemical stability with long lifetime.
3. It should be non corrosive.

![Figure 1 Parts of DSSC](image-url)
2.5 **Electrode Counter:**

The Electrode counter of Dye solar cell are developed by combination of platinum and carbon. The both electrodes are combined as packet and very helped to electrode syrings. II to I3 of liquid content of electrode have reduced by counter. From whole transport materials (HTMs) holes get collected. The most widely used counter electrode is platinum because of its higher efficiency.

3. **MECHANISM**

3.1 **Light Absorption**

The photon of Sun light is engrossed by dye solar cell and absorbed photons electrons are interchanged from one state to other state.

3.2 **Electrons Inoculation**

The previous state electrons are connected with Tio2 nano porous band which conducting with previous state of electrons.

3.3 **Transportation of Carrier**

The connected electrons are transferred from nanoparticles to diffusion and the electrode contact TCO. The above mentioned connected electrons may be reached the electrode counter by an external circuit.

3.4 **Current Production**

The counter electrode have reduced the electrons from I3 to I1. Thus color recovery or the recovery of the ground condition of the color happens because of the acknowledgment of electrons from I− particle redox go between, and I− gets oxidized to I−3.

**Excited State+ Electrons → New State**

The oxidized mediator (I-3) happens towards the counter cathode which prompts decrease of I particle.
4. RESULT AND DISCUSSION:

- Dye Solar Cell gives better performance, independent, good environment friendly, maintenance free, low cost and better efficiency.
- A Dye solar cell system may be used in any places without any grid connection.

Figure 2. Mechanism of dye sensitized solar cells.

Figure 3. Graph between DSSC and silicon solar cell.
5. CONCLUSION

Making a renewable energy is an essential step for better future. When we go ahead in renewable energy we can lead tomorrow’s world. Dssc creates a platform for making energy which are renewable and sustainable. Dye sensitized solar cells are economical. Even at low temperature and in indoor conditions better efficiency can be obtained. Dssc are effective even at cloudy and non-direct sunlight conditions making it as renewable. Thus Dssc is an alternative for silicon based solar cells.

References

[1] S. Yamuna and T. Kesavan, “Harmonic Compensation In Residential Distribution System With Mppt”, International Journal Of Applied Engineering Research, 10, Number 20, 15737-15741, 2015.

[2] John C. Sawhill, Richard Cotton, Energy Conservation: Success and Failures, Brookings Institution Press.

[3] T. Kesavan, K. Lakshmi, S. Sheeba Rani, R. Kavin, M. Senthilkumar, “Design and Study Of Interleaved Step Up DC Converter With High Level Gain For The Application Of Solar Photovoltaic Module”, International Journal Of Recent Technology And Engineering (IJRTE), ISSN: 2277-3878, Volume-7,1426-1431,Issue-6, March 2019.

[4] D.P. Kothari, Renewable Energy Resources and Emerging Technologies, Prentice Hall of India Pvt. Ltd.

[5] R. Kavin, T. Kesavan, Dr. S. Sheeba Rani, Gnanamalar K., Rameshkumar, “Optimal Charging and Discharging Planning For Electric Vehicles In Energy Saving System”, IEEE Conference Proceedings, 978-1-5386-9533-3ccv, 976-978, 2019.

[6] R. Chedid, Y. Saliba, "Optimization and Control of Autonomous Renewable Energy Systems", International Journal of Energy Research, vol. 20, no. 7, July 1996.

[7] Kavin.R, Kesavan.T, Dr. Nandagopal.V Malini.T, “Fuzzy Based Ev Charging With Reduced Power Fluctuation Under Renewable Power Consumption Constraint”, International Journal Of Pure And Applied Mathematics, Volume 119 No. 18, 1691-1706, 2018.

[8] Bansal Keemam, Meliss, Renewable Energy Sources and Conversion Technology, Tata Mc Graw Hill

[9] Clive Beggs, Energy Management, Supply and Conservation, Routledge.

[10] Prema Nagya, K.M. Nema, Saroj Rangnekar, “A current and future state of art development of hybrid system using PV system and wind energy”, Volume 13, Issue 8, October 2009.

[11] Shyamal Paul, Rabindra Nath Bhattacharya, CO2 emission from energy use in India: a decomposition analysis, Volume 32, Issue 5, March 2005.
[12] Dr. S. Sheeba Rani, T. Kesavan, Dr. V. Gomathy, A. Anie Selva Jothi, “Effectiveness Of Pitch Control Scheme In Load Balance Of WECS”, Journal Of Advanced Research In Dynamical And Control Systems, Vol.10, No.11, Pp-517-523, 2018.

[13] Kavin. R Kesavan. T, “Compensation Of Harmonics In Residential Distribution System Using Virtual Impedance”, International Journal Of Scientific Engineering And Technology, 6/8, 290-295, 2017.

[14] Kavin. R Kesavan. T, “A Smart Monitoring Of Faults In Power Transformers And Maintenance Based On Wi-Fi”, International Journal Of Engineering Research, 6/8, 382-387, 2017.

[15] T. Kesavan1, Dr. K. Lakshmi2, Dr. S. Sheeba Rani Gnanamalar3, R. Kavin, “Local Search Optimization Algorithm Based Monitoring And Controlling Of Virtual Power Plant”, For Distribution Network International Journal Of Pure And Applied Mathematics, Volume 119 No. 12, 1851-1864, 2018.