Application of Dye-Sensitized Solar Cell (Dssc) from Polyurethane (Pu)/Diol-Nai Electrolyte with Activated Carbon (Ac) Composite Electrode

Mohd Hamizan Selamat [1], *Azizah Hanom Ahmad[1,2,]

Abstract— **Application of dye-sensitized photoelectrochemical cell (DSSC) was developed using bio-based hybrid polyurethane (PU) polymer and composite electrolyte of Sodium iodide as cation of charge transport. The conducting electron transport material for the regenerative mechanism for Redox couple (I-1/I-3) was due corrosion in contacts of electrode. The polymer as additive has leveraged conductivity level of PU-composite electrolyte prepared by varying amount of Sodium iodide (NaI) via solution casting technique. These properties of composite electrolyte exhibited photoelectrochemical cell that was least corrosive (Block Membrane) for bio-based polymer electrolyte. DSSC design of heterojunction cell requires essential need of functions such as light absorption, charge regeneration -separation and transport to electrodes for a complete cell to work. The addition of polymer composite electrolyte in the redox energy separation of electrical transport was effective for bulk material of the DSSC cell system. The electrical conductivity of electrolyte material was evaluated as fair (x10−5 S.cm-1) using electrical impedance (EIS) with efficiency performance of photo-electro conversion. The hybrid-dye-sensitized solar cell of PU-Cu/TiO2-dye/PU-NaI-I2/B-AC configuration gave a response under light intensity of 100 mW cm−2 with 3.9% conversion efficiency with current density, Jsc of 0.06 mA cm−2 and open circuit voltage, Voc of 0.14 V respectively**

***Index Terms*— Activated carbon, NaI, Polyurethane diol, Composite electrolyte, Electrical Impedance,DSSC, efficiency, electrode**

I. INTRODUCTION

Dye Sensitized Solar Cells (DSSC) technology using inorganic electrolytes post problem in solvent evaporation and iodine sublimation (corroding contacts) causing instability of cells. Application of low molecular oligomers is progressing recently for an improved performance [1-5]. The electrolyte system was aimed for improving electrochemical stability using quasi-solid-state electrolytes from organic capped polymers [11-13]. A photoelectrochemical cell was developed from bio-based polyurethane (PU) polymer electrolyte with Sodium iodide (NaI) as conducting electrolyte transport material.

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Received : 25 January 2017
Accepted : 20 April 2017
Published : 30 June 2017

1.1 Dye-sensitized Solar Cell

Researchers for alternative flexible thin film solar cells are more recently based on organometal of composite based semiconductor. Solar cells based on monocrystalline silicon have reached efficiencies up to 25% while the highest efficiency of DSSC with metallic grids contacts were reaching 12% efficiency design. DSSC cell functionalities needs spectrum of light absorption, charge separation and transport of electron flow recombinant electrodes. Electrocatalyst of electron production and separation of electrical sources were combined within one bulk material as DSSC photoanode-electrode heterojunction cell. The electrical conductivity of system from composite electrolyte material was placed within band gaps electro-dynamic condition of redox Fermi energy transfer. Functional use of photoelectric performance and its efficiency with long term stability were obtained and suitable for DSSC applications where material properties must be individually optimized in views of performance of high photon to current conversion efficiency. Mesoporous structure of semicrystalline makes the fabrication easier and less expensive and low charge carrier in recombination of indirect band gap with low absorption electron coefficient. Thin film photoactive layers equated to absorb maximum sunlight intensity for the photoelectron generation with the addition of activated carbon. DSSC charge regeneration-separation and transport catalyst where the separation of electrical charges was assembled within one bulk device of DSSC hybrid system.

1.2 Electrolytes

Electrolytes play an essential role for the operation of DSSC for presence of a redox couple in the charge transfer as transient voltage commonly I-/I3- as diffusion mechanisms to restore/regenerate the oxidized dye molecules to ground state of equilibrium. The I3- ions were formed after the dye regeneration is reduced at the electrolyte to counter electrode using ions of I-. Electrolytes in DSSC were divided into three categories mainly based on their physical as liquid or quasi-solid (gel) and solid states. Liquid electrolytes have exhibited high conductivity and contributed high efficiencies of DSSC performance because of the low viscous materials composite with good pore filling in liquid-gel phase. The solvents used in the electrolyte post volatility where quasi-solid state electrolytes contribute to least usage of metals using hybrid composite material of solid electrolytes. [3-9]

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