유기고분자 재료를 이용한 우수한 효율의 태양전지

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High power efficient solar cell using the organic polymer materials

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1. Introduction

Organic materials are suitable for use in photoelectric conversion devices. Thus, Organic semiconductors are promising materials for photovoltaic devices and other optoelectronic applications such as light emitting diodes(LED). The organic solar cell seems to be the usefulness in comparison with the inorganic solar cell in terms of workability, ease of processing, low cost, flexibility and area expansion. In this paper, We selected poly(methylphenylsilane)(PMPS) as organic material, because Polysilanes are well known as a new type of σ-conjugated polymers which exhibit attractive characteristics such as photoconductivity with high hole mobility, large nonlinear optical effects and effective light emission due to one-dimensional exciton. but, In contrast to the hole transport, the electron transport is poor[1-2]. Thus, we inserted PPP layer that has high electric conductivity[3] to PMPS layer. Also, inserted Alq_3 layer into PMPS layer. And, We were investigated on the photovoltaic characteristics such as short circuit current (J_{sc}(μA/cm^2)), open circuit voltage (V_{oc}(V)), fill factor (F.F) and conversion efficiency(η).

2. Experimental

Poly(methylphenylsilane)(PMPS) polymer were synthesized by the Wurtz-coupling reaction[4] and Poly(*p*-penylene)(PPP) were synthesized by the Yamamoto method[4].

The poly(3,4-ethylenedioxythiophene)(PEDOT):poly(4-styrene sulfonate)(PSS) (Baytron P, received from Bayer Co., Germany) layer with a 50nm was inserted as a buffer layer to remove the leakage current

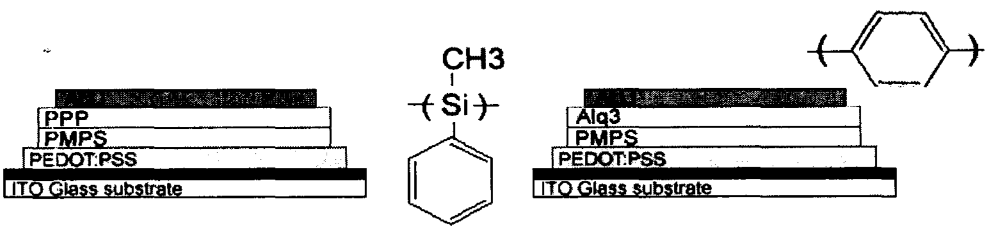

Fig.1. Schematic diagram of AAl:Li/PPP/PMPS/ITO photovoltaic cell and Al:Li/Alq_3/PMPS/ITO photovoltaic cell.

The fist device fabricated by the following ; First, PMPS was dissolved in THF(1.5wt%). The prepared solution was filtered by 0.2㎛ filer. and spin-coated on the ITO glass substrate. After spin-coating, it was dried at 60℃ for 10 hour. PPP film (100nm) was thermally evaporated onto the ITO glass coated PMPS solution. finally, Al:Li was deposited as a anode. The roughness and thickness of PMPS film was measured with a atomic force microscopy (AFM, TopoMetrix).

The second device fabricated by the following : The way such as upside, PMPS was spin-coated on the ITO glass. After, Alq_3 was deposited onto the ITO glass coated PMPS solution. A schematic diagram of the Al:Li/Alq_3/PMPS/ITO photovoltaic cell is shown in Fig.1. The photo-active area was 1.5×2mm.

The photovoltaic measurements were carried out using an electrometer(keithley 236) under irradiation of white light from a 300W Xe lamp

3. Results and discussion

The Current-voltage characteristics for Al:Li/PMPS, Al:Li/Alq_3/PMPS and Al:Li/PPP/PMPS are following. The PMPS/Alq3/Al;Li and PPP/PMPS/Al:Li structure has a conversion efficiency η of 0.27%, FF of 0.32 and J_{sc} 38μA/cm^2, V_{oc} of 0.89V and conversion efficiency η of 0.17%, FF of 0.25 and J_{sc} 32μA/cm^2, V_{oc} of 0.83V, compared with PMPS/Al of conversion efficiency η of 0.2%, FF of 0.27, J_{sc} 33μA/cm^2 and V_{oc} of 0.87V.

4. Conclusion

The conversion efficiency η of the photovoltaic devices was slightly increased by insertion of PEDOT:PSS buffer layer, and Also, current leakage was eliminated. but PPP and Alq3 is not show remarkable result.

Acknowledgement

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5. References

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