

초분자 고체전해질을 이용한 고효율 염료감응형 태양전지

김 선영¹⁾, 전 라선²⁾, 이 용건³⁾, 강 용수⁴⁾

Solid-state Supramolecular polymer electrolytes containing double hydrogen bonding sites for high efficiency dye-sensitized solar cells (DSSCs)

Sunyoung Kim¹⁾, La Sun Jeon²⁾, Yong-Gun Lee³⁾, Yong Soo Kang⁴⁾

Key words : Supramolecule (초분자), Polymer electrolyte (고분자 전해질), Solid-state DSSCs (고체형 염료감응태양전지), Hydrogen bonding (수소결합)

Abstract : Supramolecules containing double hydrogen bonding sites at their both chain ends were self-polymerized to become solid state polymer and were utilized to improve the efficiency of solid state DSSCs. Hydrogen bonding sites were attached at the chain ends of PEG of Mw=2000, such as pyrimethamine and glutaric acid. The solar cell with the solid state supramolecular polymer electrolyte resulted in the overall energy conversion efficiency of 4.63 % with a short circuit current density (J_{sc}) of 10.41 mAcm^{-2} , an open circuit voltage (V_{oc}), of 0.71 V and a fill factor (FF) of 0.62 at one sun condition ([oligomer]:[1-methyl-3-propyl imidazolium iodide (MPII)]:[I₂] = 20 : 1 : 0.19, active area = 0.16 cm^2 , TiO₂ layer thickness = 10 μm). The ionic conductivity of the solid state electrolyte was $5.11 \times 10^{-4} \text{ (S/cm)}$. The cell performance was characterized by electrochemical impedance spectroscopy and ionic conductivity.

Nomenclature

2H-polymer (2 hydrogen bonded polymer) : Double hydrogen bonded polymer

subscript

I₃⁻ : tri-iodide
I⁻ : iodide

1. Introduction

The development of stable DSSCs is desirable, because of their intrinsic advantages, such as long-term durability and proper mechanical strength. However, their energy conversion efficiency (2~4%) is still much low compared to that corresponding to liquid-state DSSCs (~11%). Thus, employed are oligomeric

supramolecules containing double hydrogen bonding sites at both chain ends of the poly(ethylene glycol) to improve the efficiency of solid-state DSSCs.

2. Synthesis of 2H-polymer

To get high efficiency with oligomer by

-
- 1) 한양대학교
E-mail : syssyy@hanmail.net
Tel : (02)2296-2968 Fax : (02)2296-2969
 - 2) 한양대학교
E-mail : sivita@nate.com
Tel : (02)2296-2968 Fax : (02)2296-2969
 - 3) 서울대학교
E-mail : egyg23@dreamwiz.com
Tel : (02)2296-2968 Fax : (02)2296-2969
 - 4) 한양대학교
E-mail : kangys@hanyang.ac.kr
Tel : (02)2296-2968 Fax : (02)2296-2969

5. Acknowledgement

In we acknowlege the financial support of the Ministry of Commerce industry and Energy, and Korea Energy Management Corporation, and the Ministry of Education through the Brain Korea Program at Hanyang University.

References

- [1] N. Stanley and M. Weber et. al., 2002, "Crystal Engineering of Organic Salts: Hydrogen-Bonded Supramolecular Motifs in Pyrimethamine Hydrogen Glutarate and Pyrimethamine Formate", *Crystal growth & design Chemical Physics*, 6, 631
- [2] L. Brunsveld, R. P. Sijbesma, 2001, "Supramolecular polymers", *Chem. Rev.*, 101, 4071