

Platinum and carbon nano tube addition in carbon black counter electrode for dye-sensitized solar cells

Su Young Lee*, Sang Ho Kim*

School of Energy, Materials & Chemical Engineering, Korea University. of Technology and Education

(E-mail: shkim@kut.ac.kr)

초 록 : Platinum (Pt) has been commonly used as a counter electrode material in dye-sensitized solar cells, because it has high catalytic activity and electric conductivity as well as chemical inertness with iodide electrolyte. However, Pt is too expensive to be commercialized. Therefore, in the present study, carbon black counter electrode with Pt and carbon nano tube (CNT) was investigated. The power conversion efficiency with Pt added carbon black electrode was lower than that of pure Pt electrode which was 6.47 %. By adding 3 wt% Pt to the carbon black counter electrode, the power conversion efficiency was maximized at 5.88 %. On them, additional adding of 1 wt % CNT, the power conversion efficiency (η) was increased up to 6.21%. The reason of power conversion efficiency improvement with a proper amount of Pt and CNT was examined by comparing the impedance properties measured using EIS.

1. 서론

Dye-sensitized solar cell (DSSC) has been attracted attentions as a next generation solar cell with low product cost and high power conversion efficiency. The commonly used platinum (Pt) counter electrode has low resistance and high electro-catalytic activity, but the Pt is too expensive for commercial applications. Therefore, a cheaper carbon material has been recently attracted more interest as a counter electrode material. In his study, the effects of the Pt and CNT additives in carbon black were investigated in terms of the I-V, FF, V_{oc} , J_{sc} and power conversion efficiency (η) of built-up DSSC.

2. 본론

Titanium oxide (TiO₂) paste (20nm, Solaronix) was uniformly coated by screen printed on the FTO glass as a working electrode. The TiO₂ electrode was sintered at 500°C for 30 min, and then it was screen printed again for fabrication scatter layer (400 nm, Solaronix). The sintered TiO₂ electrode was immersed in 0.3 mM dye solution (N719, Solaronix) for 24 h.

To synthesize counter electrode precursor, α -terpineol and ethyl cellulose powder were mixed together for 30 min on a hot plate, and then carbon black powder and 1 - 4 wt% of H₂PtCl₆·6H₂O were added and mixed. Finally, a few ratios of CNT powder (0.2 - 3 wt%, length 5 μ m, and diameter 15nm) were mixed together in the paste. The synthesized counter electrode precursor was coated by screen printing on the FTO glass, which was sintered at 450 °C for 30min.

3. 결론

Indicates the power conversion efficiency of DSSCs with CNT added Pt (3 wt%)/carbon black counter electrode. The power conversion efficiency increased with CNT amount and reaches at a maximum value with 1 wt% CNT, and then

decreased with the more 2-3 wt% of CNT. Table 2 shows the photovoltaic parameters of DSSCs depend on the CNT addition in the Pt (3 wt%)/carbon black counter electrode. When the pure Pt counter electrode was used, V_{oc} 0.73V, J_{sc} of 12.81mA/cm², FF of 67.91%,and power conversion efficiency of 6.47 % were achieved.

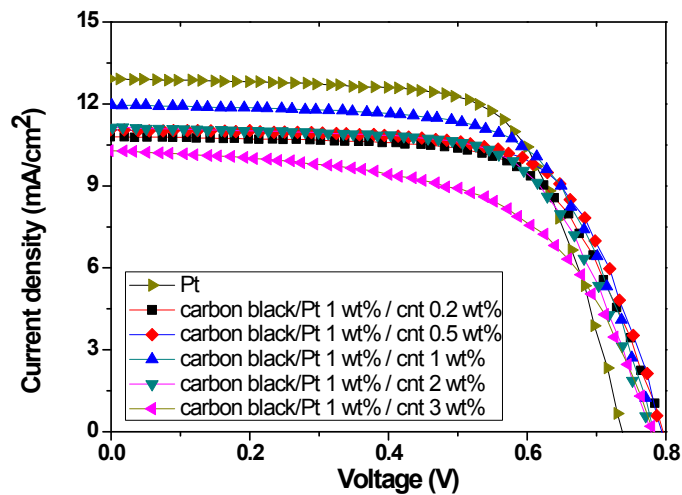


Fig. 1. I-V curves of CNT added Pt (3 wt%)/carbon black counter electrodes under AM 1.5-100 mW/cm² light irradiation.

참고문헌

- [1] B.O'Regan, M. Gratzel, Nature **353**,737(1991).
- [2] W.J. Lee, E. Ramasamy, D.Y. Lee, J.S. Song, Sol. Energy Mater. Sol. Cells **92**,813-818(2008).
- [3] K.M. Lee, C.W. Hu, H.W. Chen, K.C. Ho, Sol. Energy Mater. Sol. Cells **92**,1628-1633(2008)