Carbon nanotube-incoporated photoanode and its electrochemical properties for dye-sensitized solar cells

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ABSTRACT

This study divided into two parts, the first part to look at a variety of (LiI, NaI, KI) and Propylene carbonate (PC) the composition of the electrolyte system to AC impedance method (AC Impedance), etc. Characteristics of electrochemical; as a dye-sensitized solar cells (Dye-Sensitized Solar Cell, DSSC) electrolyte systems, measurement of its Photoelectric conversion efficiency on a variety of electrolyte systems for the photovoltaic characteristics of the impact of components. The second part of this study was primarily aimed at the working electrode, in order to spin a good TiO2 coating solution will be allocated to the ITO coated glass as working electrode after sintering, and with different thickness, to observe the heterogeneous structure of the photoelectric conversion efficiency. Electrolytes are EKM-034 (0.34 M KI +0.01 M I2 in PC), ENM-034 (0.34 M NaI +0.01 M I2 in PC), ELM-034 (0.34 M LiI +0.01 M I2 in PC) to observe the performance of its IV. The results showed that TiO2 film with the working electrode is directly proportional to the number of spin-coating, and when the working electrode thickness reached at 9.1 μm (six), with the best of the photoelectric conversion efficiency, when it increased again when the electrode thickness, light no further increase in power conversion efficiency, but slightly short-circuit current.　　Based on the above conclusions, the best known of these study process parameters: TiO2 layer six, electrolyte is ELM-034, may be the largest photovoltaic conversion efficiency, η = 6.33 %, PV test results are: VOC = 0.730 V, JSC = 15.36 mA, FF = 56.46 %. Heterogeneous structure can futher uprade photovoltaic conversion efficiency, The structure of ITO / P25-TiO2 (6L) / CNT, PV test results are as follows; VOC = 0.690 V, JSC = 18.44 mA, FF = 53.60 %, η = 6.82 %; the structure of ITO / Sol-Gel TiO2 (3L) / P25-TiO2 (6L) / CNT, PV test results are as follows; VOC = 0.657 V, JSC = 18.06 mA, FF = 55.26 %, η = 6.56 %; the structure of ITO / SnO2 / Sol-Gel TiO2 (3L) / P25-TiO2 (6L) / CNT, PV test results are as follows; VOC = 0.663 V, JSC = 19.15 mA, FF = 55.40 %, η = 7.03 %. It can be seen: The carbon nanotube-modified working electrode of titanium dioxide, contribute to dye-sensitized solar photovoltaic conversion efficiency.

AC Impedance analysis and PV measurement shows: PC solvent system, electrolyte Composition its size LiI > NaI > KI.

Keywords : Dye-Sensitized Solar Cell、AC Impedance、electrolyte、carbon nanotubes

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