Fabrication and Electrochemical Study of Carbon Nanotubes-Modified TiO2 Dye-Sensitized Solar Cells

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ABSTRACT

In this study, titanium dioxide (TiO2) with different percentage of carbon nanotubes (carbon nanotubes, CNTs) as a dye-sensitized solar cells (Dye-Sensitized Solar Cells, DSSC) of the working electrode. The working electrode with carbon nanotubes titanium dioxide with the advantages of the dual characteristics, and to explore the characteristics of electricity. In addition, increased heterogeneity of structural changes in order to study the process parameters on the dye-sensitized photovoltaic solar cell efficiency. In this study, commercial TiO2 nanocrystalline powders (Degussa P25) were used to fabricate the working electrode of porphyrin-sensitized solar cells(DSSC). carbon nanotubes added to its structure in order to spin coating method TiO2/CNTs film generated at the same time comparison Sol-gel SnO2 by Sol-gel TiO2 and formed underlayer, such as the structure of the working electrode in different thickness and adding different proportions of carbon nanotubes and other conditions, the production of dye-sensitized solar cell, the photoelectric conversion efficiency characteristics. Identification of the material, in terms of XRD, SEM, UV-VIS analysis of the crystallization of membrane properties, surface pattern and degree of optical penetration.

Experimental results show that: the work does not add carbon nanotube electrode, when the film thickness for 9 μ m when measured by the highest photoelectric conversion efficiency, the Voc = 0.74V, Jsc = 14.1 mA/cm2, FF = 0.56, η = 5.93%. Increasing film thickness can not significantly enhance the overall photoelectric conversion efficiency. Add carbon nanotubes on the working electrode, dye-sensitized solar cells contribute to efficiency, with the proportion of the carbon nanotubes 0.025wt% the best. The Voc = 0.74V, Jsc = 13.96 mA/cm2, FF = 58.77, η = 6.04%. If the ratio of carbon nanotubes to add too much, this will result in dye-sensitized solar cell efficiency. Finally, Sol-gel SnO2 stack as a Sol-gel TiO2 structure underlayer, the formation of new dye-sensitized cell structure: ITO/SnO2/SG-TiO2/TiO2-CNT, the working electrode can increase the adsorption of dyes and to enhance the work of visible light absorption efficiency of the electrode. The Voc = 0.74V, Jsc = 16.22 mA/cm2, FF = 57.59, η = 6.89%. It can be seen: The carbon nanotube-modified working electrode of titanium dioxide, contribute to dye-sensitized solar photovoltaic conversion efficiency.

Keywords : TiO2、carbon nanotubes、Dye-Sensitized Solar Cells、DSSC

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