



Pd–Co-doped carbon nanofibers with photoactivity as effective counter electrodes for DSSCs

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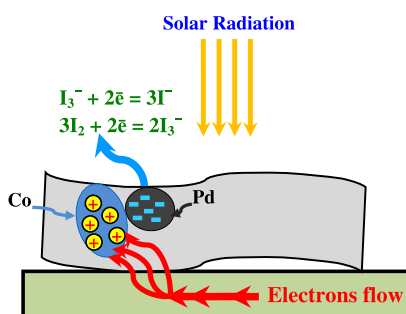
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HIGHLIGHTS

- ▶ Pd–Co-doped carbon nanofibers were synthesized using simple and effective technique.
- ▶ New class of materials based on photoactivity can be used as counter electrodes in DSSCs.
- ▶ The introduced bimetallic nanofibers are sheathed in highly crystalline carbon.
- ▶ The introduced nanofibers revealed good performance as cathode in the DSSCs.

GRAPHICAL ABSTRACT



ARTICLE INFO

Article history:

Received 28 June 2012

Received in revised form 24 August 2012

Accepted 14 September 2012

Available online 23 September 2012

Keywords:

Metallic nanofibers

Electrospinning

Pd-doped cobalt

Dye sensitized solar cells

Photocathodes

ABSTRACT

Utilizing precious metals as counter electrodes in the dye sensitized solar cells prevents wide applications of this interesting energy device because of the cost aspect. Due to the axial ratio feature, nanofibers are expected to have novel characteristics. In this study, Pd–Co-doped carbon nanofibers could be successfully prepared using simple, low cost, high yield and effective technique; electrospinning. As a counter electrode material in the dye sensitized solar cell, the introduced nanofibers revealed good performance as the fabricated DSSC attains relatively high short-circuit current density (J_{sc}) of 9.8 mA/cm² and open circuit voltage (V_{oc}) of 0.705 V. Beside the known catalytic activity, the utilized metallic carbon nanofibers revealed a band gap of 4.7 eV which simultaneously enhances the iodine reduction on the electrode surface. Moreover, the introduced nanofibers have the advantage of chemical stability because the metallic nanoparticles are sheathed inside a crystalline carbon shell. The introduced nanofibers have been synthesized by calcination of electrospun nanofibers composed of Pd nanoparticles/cobalt acetate tetrahydrate/poly(vinyl alcohol) in a vacuum atmosphere. Overall, the introduced manuscript might open new avenue to utilized new class of materials as counter electrodes based on photoactivity co-assistance.

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1. Introduction

Dyes-sensitized solar cells (DSSCs) are devices devoted to the conversion of solar energy into electricity based on a large band

gap nanocrystalline semiconductor sensitized by a dye which is chemically linked to the semiconductor surface and has substantial absorption in the visible range. The nanocrystalline DSSC technology was pioneered by Grätzel in the early nineties and its best conversion efficiency reported is more than 10% [1]. In a typical photochemical solar cell, a semiconducting film serves as a photoactive electrode that upon excitation with visible light generates electron–hole pairs. As one of the charge carriers (e.g., the electron)

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