

Electronic Supplementary Information

An efficient 3C-silicon carbide/titania nanocomposite photoelectrode for dye-sensitized solar cell

Yan-Chou Lai and Yu-Chen Tsai*

Department of Chemical Engineering, National Chung Hsing University, 250, Kuo Kuang Road, Taichung 402, Taiwan

* Corresponding author. Tel.: +886-4-22857257; Fax: +886-4-22854734

E-mail address: yctsai@dragon.nchu.edu.tw

Experimental details

Reagents

TiO₂ nanoparticles were purchased from Degussa (P25, 80% anatase).

4-tert-butylpyridine (TBP) was obtained from Aldrich. I₂ was purchased from Merck.

H₂PtCl₆, 3C-SiC (20 nm), 6H-SiC (2 μm), and LiI were purchased from Alfa Aesar.

Polyethylene glycol (Mw = 16,000-24,000) and 3-methoxypropionitril (MPN) were

obtained from Fluka. *Cis*-(NCS)₂-Ru(II)-bis(2,2'-bipyridine-4,4'-dicarboxylate) dye

(N719) and 1-propyl-2,3-dimethylimidazolium iodide (DMPH) were purchased from

Solaronix. The reagents were used as purchased without any further pretreatment.

Apparatus

Field emission scanning electron microscopy (FESEM) images were obtained using a

JSM-6700F (JEOL, Japan). J - V characteristics were measured with a Keithley 2400 source meter under illumination from a solar simulator composed of a 500 W Xe lamp and an AM 1.5 filter (Oriel). Light intensity was calibrated with a silicon photodiode. Electrochemical impedance measurement was performed with an Autolab PGSTAT30 Electrochemical Analyzer with FRA2 module (Eco Chemie, Netherlands) under AM 1.5 (100 mW cm^{-2}) illumination and in the dark. The frequency range explored was from 0.01-65000 Hz.

Preparation of the 3C-SiC/TiO₂ nanocomposite photoelectrodes

3C-SiC/TiO₂ pastes were prepared with addition of appropriate amount of 3C-SiC in 2 ml of 5 wt% TiO₂ and mixed with polyethylene glycol (PEG) at a 0.3 of PEG/TiO₂ ratio with the aid of ultrasonic agitation for 1h. The paste was coated by using the doctor blade technique onto FTO (Solaronix) and annealed at 450 °C for 30 min in the air to obtain a 3C-SiC/TiO₂ nanocomposite film. The thickness of the 3C-SiC/TiO₂ nanocomposite was varied from 4.0 to 16.1 μm , which was determined by FESEM.

Preparation of the DSSCs

The above prepared photoelectrode had a 0.25 cm^2 active area which was immersed in ethanol containing 0.5 mM N719 for 24 h. The counter electrode was prepared by

spin-coating of H_2PtCl_6 solution (7 mM in ethanol solution) onto FTO and heated at 400 °C for 15 min. The DSSCs were sealed with sealing material, SX1170 (Solaronix). The electrolyte consisted of 0.1 M LiI, 0.05 M I_2 , 0.6 M DMPII, and 0.5 M TBP in MPN.

Additional result

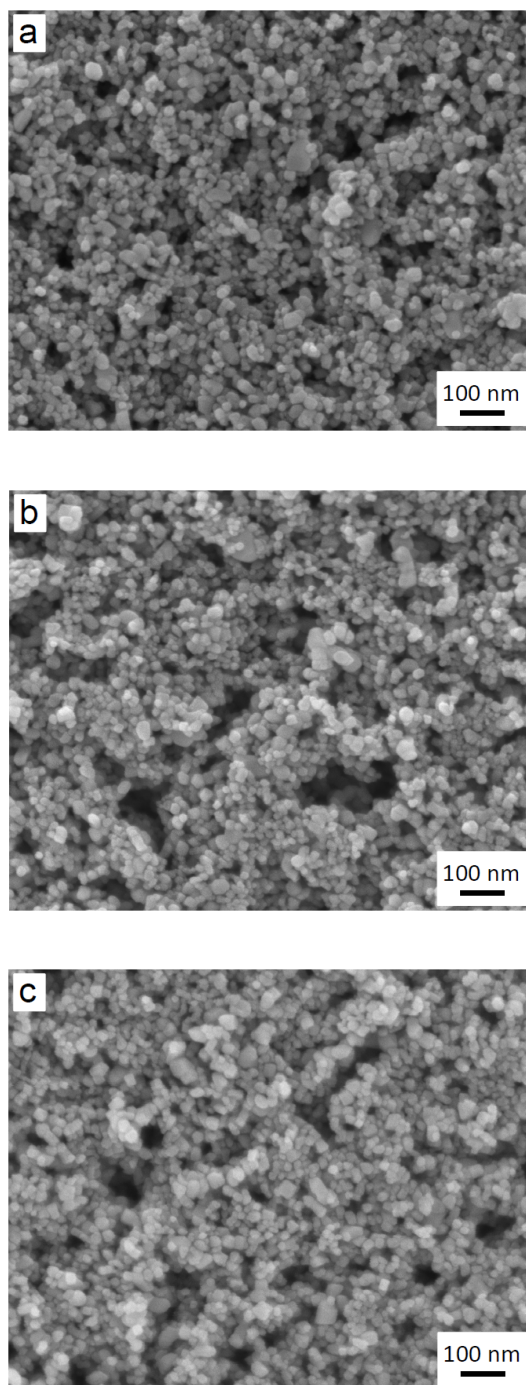


Fig. S1. FESEM images of (a) nanocrystalline TiO₂ film photoelectrode, (b) 3C-SiC (0.01 wt%)/TiO₂ nanocomposite photoelectrode, and (c) 6H-SiC (0.01 wt%)/TiO₂ nanocomposite photoelectrode.