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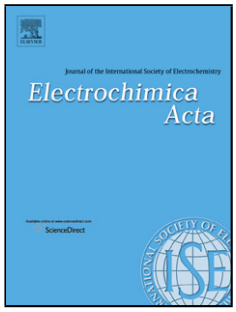

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Influence of zirconium dioxide and titanium dioxide binders on the photovoltaic performance of dye sensitized solar cell tungsten carbide nanorods based counter electrode

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Abstract

A facile hydrothermal method to synthesize tungsten carbide nanorods (WC-NRs) with mixture of zirconium oxide (ZrO_2) and titanium dioxide (TiO_2) materials for counter electrode (CE) in dye sensitized solar cell (DSSC) application is described. The synthesized materials were characterized by suitable analytical techniques such as X-ray diffraction (XRD), field emission scanning electron microscopy (FESEM), transmission electron microscopy (TEM), Brunauer-Emmett- Teller (BET) surface area analysis and energy dispersive spectra analysis (EDS). The electrochemical behavior of WCNRs, WCNRs-ZrO_2, WCNRs-TiO_2 and WCNRs-ZrO_2-TiO_2 modified counter electrodes were studied using electrochemical impedance spectroscopy (EIS) techniques. The DSSC assembled with the WCNRs-ZrO_2, WCNRs-TiO_2, WCNRs-ZrO_2-TiO_2 based counter electrode demonstrated an enhanced solar to electrical energy conversion efficiency (2.29%, 1.59%, 1.92%) compared to that of binder free WCNRs (0.59%), due to the increasing bonding strength of material to substrate. The enhanced solar energy conversion efficiency demonstrated by the WCNRs-ZrO_2 makes it a promising candidate to Pt-free DSSC.

Keywords: Tungsten carbide, Nanorods, Counter electrode, Solar Energy, Binder

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