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A low-cost, vein graphite/tin oxide nanoparticles based composite counter electrode for efficient dye-sensitized solar cells

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Highlights

- Novel graphite/SnO_2 composite counter electrode for dye solar cells is presented.
- Solar cells fabricated with this electrode exhibited an efficiency of 7.95%.
- This is an efficiency increase of 32% compared to a pure vein graphite electrode.
- Enhanced efficiency is largely attributed to improved electrocatalytic effect by SnO_2.

Abstract

Performance of dye sensitized solar cells made with a novel, low cost graphite/SnO_2 composite counter electrode is demonstrated. The best performance is exhibited by the composite made with 3.0 ml colloidal SnO_2 solution and 0.05 g of graphite powder, sintered at 450 °C. The solar cell efficiency was increased from 6.02% for pure vein graphite to 7.95% for optimized composite graphite/SnO_2 electrode, which is 86% of the efficiency of 9.25% obtained for Pt electrode. This impressive 32% increase in efficiency can be associated with highly porous nanostructure of the graphite/SnO_2 composite providing more reaction sites for triiodide ion reduction as confirmed by Scanning Electron Microscopy, X-ray diffraction and Raman Spectroscopy. Excellent electrocatalytic activity exhibited by the new counter electrode is confirmed by Electrochemical Impedance Spectroscopy and Cyclic Voltammetry, further supported by Tafel plot analysis. This result provides a cost-effective method to fabricate efficient counter electrodes for dye sensitized solar cells.

Keywords

Dye-sensitized solar cells, Counter electrodes, Vein graphite/SnO_2