



Improvement of light scattering capacity in dye-sensitized solar cells by doping with SiO₂ nanoparticles



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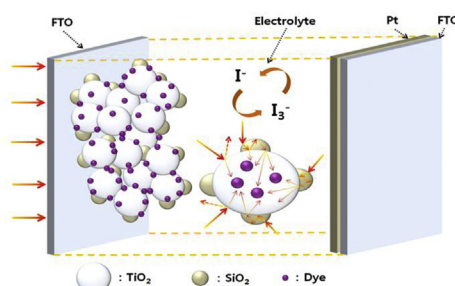
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HIGHLIGHTS

- Addition of SiO₂ enhanced charge transfer and reduced charge recombination.
- Addition of SiO₂ and N supplied high surface area and strong absorption of light.
- The highest power conversion efficiency was 8.68%.
- This efficiency was increased about 49.7% in comparison to TiO₂.

GRAPHICAL ABSTRACT



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ABSTRACT

N-doped TiO₂ was further doped with SiO₂ to prepare SiO₂/N-doped TiO₂ photoelectrodes with high activity in the visible region. A sol-gel process was employed to produce nanoparticles of SiO₂/N-doped TiO₂. The addition of SiO₂ to the metal oxide enhanced charge transfer and reduced charge recombination. With the addition of sufficient amounts of SiO₂ and N, the photoelectrodes exhibited a high surface area and strong absorption of light because of their altered absorptivity in the visible wavelength region. These characteristics enabled the production of photoelectrodes with increased charge transfer and reduced charge recombination, resulting in dye-sensitized solar cells (DSSCs) with enhanced J_{sc} values. The SiO₂/N-doped TiO₂ photoelectrodes were characterized using a range of analysis techniques. After the J - V curve measurements, the DSSCs fabricated with the 0.1 mM SiO₂/N-doped TiO₂ photoelectrodes exhibited the highest energy conversion efficiency of 8.68%, which was approximately 3% higher than that of the N-doped TiO₂ control groups. This high energy efficiency with the addition of SiO₂ might be due to the enhanced surface area of the photoelectrodes, allowing more dye absorption, and a decrease in electron recombination.

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1. Introduction

In 1991, Grätzel et al. introduced dye sensitized solar cells (DSSCs), which are composed of photoelectrodes, counter electrodes, dyes, and electrolytes. The electric power is generated by

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