



# Improvement of light scattering capacity in dye-sensitized solar cells by doping with SiO<sub>2</sub> nanoparticles



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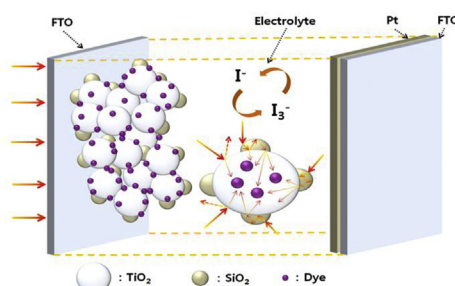
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## HIGHLIGHTS

- Addition of SiO<sub>2</sub> enhanced charge transfer and reduced charge recombination.
- Addition of SiO<sub>2</sub> 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 TiO<sub>2</sub>.

## GRAPHICAL ABSTRACT



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## ABSTRACT

N-doped TiO<sub>2</sub> was further doped with SiO<sub>2</sub> to prepare SiO<sub>2</sub>/N-doped TiO<sub>2</sub> photoelectrodes with high activity in the visible region. A sol-gel process was employed to produce nanoparticles of SiO<sub>2</sub>/N-doped TiO<sub>2</sub>. The addition of SiO<sub>2</sub> to the metal oxide enhanced charge transfer and reduced charge recombination. With the addition of sufficient amounts of SiO<sub>2</sub> 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 SiO<sub>2</sub>/N-doped TiO<sub>2</sub> photoelectrodes were characterized using a range of analysis techniques. After the  $J$ - $V$  curve measurements, the DSSCs fabricated with the 0.1 mM SiO<sub>2</sub>/N-doped TiO<sub>2</sub> photoelectrodes exhibited the highest energy conversion efficiency of 8.68%, which was approximately 3% higher than that of the N-doped TiO<sub>2</sub> control groups. This high energy efficiency with the addition of SiO<sub>2</sub> 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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