

# Synergistic combination of electronic and electrical properties of SnO<sub>2</sub> and TiO<sub>2</sub> in a single SnO<sub>2</sub>-TiO<sub>2</sub> composite nanofiber for dye-sensitized solar cells

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## A B S T R A C T

Tin dioxide (SnO<sub>2</sub>) and titanium dioxide (TiO<sub>2</sub>) are popular metal oxide semiconductors; they are explored for many applications because of their unique properties. This paper details that electronic and electrical properties of SnO<sub>2</sub> and TiO<sub>2</sub> can be synergistically combined in an one-dimensional nano-structure, such as electrospun nanofibers. The resulting composite nanofibers (CNFs) showed beneficial properties when used as a photoanode in dye-sensitized solar cells (DSSCs). In particular, the CNFs showed higher conduction band energy than SnO<sub>2</sub> and higher electrical conductivity than TiO<sub>2</sub>. The SnO<sub>2</sub>-TiO<sub>2</sub> CNFs are synthesized by electrospinning a polymeric solution containing equimolar concentration of tin chloride and titanium alkoxide precursors and subsequent annealing. The composite formation is demonstrated by X-ray diffraction and energy dispersive X-ray measurements and morphology by scanning electron microscopy. Synergy in electronic and electrical properties are demonstrated by cyclic voltammetry, absorption spectroscopy, and electrochemical impedance spectroscopy. Dye-sensitized solar cells fabricated using the CNFs as photoanode showed higher open circuit voltage and short circuit current density than those achieved using pure SnO<sub>2</sub> and pure TiO<sub>2</sub>, respectively.

**Keywords:** Renewable energy, Energy conversion materials Photovoltaics, Hybrid nanofibers Electrospinning