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# High-Efficiency Dye-Sensitized Solar Cells Based on TiO2 Nanotubes

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# BACKGROUND

Photovoltaics have thus far been largely based on semiconductors, e.g., Si, CdTe, and cadmium indium selenide. Solar cells using these materials have increasingly been available commercially but still need improvement relative to stability, cost, and environmental concerns.

A leading alternative solar-cell technology relies on photoelectrochemistry and the absorption and excited-state properties of dye molecules bound to a TiO<sub>2</sub> substrate. Research on such dye-sensitized solar cells (DSSCs) has targeted and achieved higher efficiency. The prevailing approach in fabricating DSSCs has been based on mesoporous random networks of TiO<sub>2</sub> nanocrystals. This approach however suffers from increases in resistance and recombination losses.

## **TECHNOLOGY DESCRIPTION**

UC San Diego researchers have developed new dye sensitized solar-cells, which are based on aligned TiO<sub>2</sub> nanotubes that exhibit improved electron collection efficiency relative to earlier DSSCs. The invention's architecture provides a direct and low-resistance conduit for electron capture while maintaining a very high surface area for covalently binding inorganic or organic sensitizers. With the invention, light can be effectively absorbed even in the near-IR region because the path-length of the TiO<sub>2</sub> nanotube layer is significantly greater than the thickness of the mesoporous TiO<sub>2</sub> layer of traditional DSSCs. The invention provides embodiments that do not require transparent conductive glass at either electrode, which leads to increased efficiency, simplified and compact design, and enhanced manufacturability.

# PATENT STATUS

Country	Туре	Number	Dated	Case
United States Of America	Issued Patent	9,368,289	06/14/2016	2009-164

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#### OTHER INFORMATION

#### KEYWORDS

photovoltaic, solar cell, dye sensitized

solar cell, TiO2, nanotube

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