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# New look for solar cells

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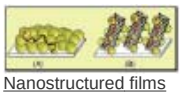
**Researchers in the US have shown that carbon nanotubes can significantly improve the efficiency of solar cells made of titanium dioxide, a readily available and cheap chemical routinely used in paint and sunscreen. Prashant Kamat and colleagues at the University of Notre Dame, Indiana, anchored titanium dioxide nanoparticles on single-walled carbon nanotubes and found that the efficiency of converting ultraviolet light into current was doubled compared to that using the nanoparticles alone.**

Researchers are interested in using the photocatalytic activity of nanostructured semiconductor films to design solar cells. Of particular importance is the dye-sensitized solar cell, which uses nanostructured titanium dioxide ($TiO_2$) films modified with sensitizing dyes. Such cells are appealing because nanoparticles have a great potential for absorbing light and generating electrons. However, despite the initial success of achieving 10% solar conversion efficiency, efforts to further improve their performance have been difficult and the performance of devices made of such cells lies well below that of conventional silicon solar cells. This is because it is difficult to harness all the electrons generated in the nanostructured $TiO_2$ cells to create a current.


Nanostructured films

Now, Kamat and colleagues have used carbon nanotubes to direct the flow of photogenerated charge carriers so that they can reach an electrode more easily, where they can then generate an electrical current. The nanotubes effectively "collect" the electrons and provide a more direct route to the electrode, therefore improving the efficiency of the solar cells (see figure).

The Notre Dame researchers achieved their result by forming a mat of carbon nanotubes on carbon fibre and glass electrodes. The nanotubes serve as a scaffold on which $TiO_2$ particles are then deposited. Kamat says that this is a very simple solution for bringing order into a disordered structure.

The new carbon nanotube-nanoparticle system has not yet been made into a practical solar cell because the $TiO_2$ only absorbs ultraviolet light – most of the visible spectrum of light is reflected. However, the researchers say they have already shown ways to absorb light in the visible region too, by coating the nanoparticles with quantum dots (tiny semiconductor crystals). Here, the dots can convert high-energy photons into multiple electrons, unlike in conventional materials in which one photon generates just one electron.



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