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# Improving the Solar Cell with Nanoscience

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Solar cells are a popular form of photovoltaic cells that can harvest light coming from the sun and convert it into a usable form of energy on earth. Even though the idea of getting electricity without pollution or the need for fossil fuels is appealing, it is still difficult to find a city, factory or even a single house that is completely powered by solar energy. A possible reason solar cells are not yet widely utilized is because of their low conversion efficiency and high fabrication costs. To improve the solar cell's efficiency and lower its production cost, many research groups around the world are using new materials; materials developed through nanoscience and nanotechnology.

One promising type of solar cell uses electrodes similar to those in a battery to conduct current from one part of the cell to the other. The electrode is of particular interest to scientists because it has to meet specific requirements in order to function properly, and because there are few materials on earth that can meet these requirements. One material that does is tin-doped indium oxide (ITO); it is transparent—allowing sunlight to enter the cell at the correct wavelength—and conductive, allowing the electrons to move freely around the cell to the load with little resistance (Rowell and others 2006). However, indium is used for many other applications, so its supply is slowly decreasing and its price is rising. ITO is also quite brittle, so if one were to bend it into a cylinder with a diameter of one centimeter it would completely lose its conductivity and form cracks big enough to be able to see with an unaided eye (Rowell and others 2006). These problems have created a growing need for a replacement for ITO.

A possible alternative for ITO is the random carbon nanotube network film. If carbon nanotubes are synthesized and arranged properly, the resulting film could exhibit conductivity, transparency at the visible spectrum, and flexibility. As the name implies, the carbon nanotubes are made of carbon, an element that is abundant on our planet. In addition to easy access to carbon, these films are solution processable, so they are cheaper to make. Their costs are decreasing from the current $0.75 per square meter compared to the $1.00 per $m^2$ of ITO (Topinka and others 2006). The only problem is the slightly lower efficiency of the carbon nanotubes' conductivity: 2.5% compared to 3% efficiency of ITO (Topinka and others 2006). Researchers believe the problem lies in the series resistance of the films, so many resources and much time are being directed towards its solution.

Thanks to nanoscience and nanotechnology, it will be possible, one day, to use random carbon nanotube network films as electrodes in devices such as solar panels, flat-panel displays, touch screens, solid-state lighting and many others (Northwestern University 2008). These new areas of research are enabling us to improve existing technologies, develop new and enhanced materials, and create new things.

## REFERENCES

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