Photosynthetic Solar Cells

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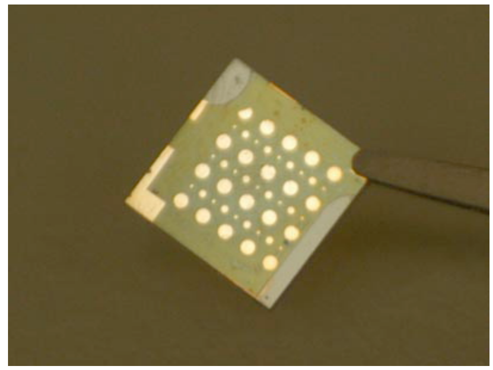
A "Photosynthetic solar cell" is an unconventional solar cell in that this type of solar cell taps a plant's use of photosynthesis in order to create electrical energy for uses beyond the plant's normal use.

Photosynthetic solar cells are a relatively new technology because the barrier of separating a plant from a permanent water supply in order to live was not realized until recently. In April 2004, group research conducted by scientists at MIT, the University of Tennessee, the US Naval Research Laboratory, and the Defense Advanced Research Projects Agency was presented to *Nano Letters* illustrating how they were able to harness energy that plants use during photosynthesis. This research was the first of its kind in being able to extract electrical current from a plant's photosynthesis for three weeks, thus overcoming the obstacle of providing water to the proteins that capture energy.

This first organic solar cell was created by extracting a protein complex called Photosystem I (PSI) from ground up spinach chloroplasts. The protein was then placed on the chip with spaces in between each protein. A peptide detergent, developed by Shuguang Zhang of the Biomedical Engineering Department at MIT, was then placed in the spaces between the proteins. The proteins and the detergent interlocked in a process dubbed "self-assembly". The detergent was the link that provided the means for the protein complexes to remain functional on the surface of the chip by providing water within the detergent to the proteins.

Under the proteins is a transparent glass coated with a conducting material. A thin layer of gold is then placed onto the chip to help the chemical reaction that assembles the spinach proteins. An organic semiconductor is evaporated afterward to protect the chip from electrical shorts.



-PSI ranges from 10-20 nanometers wide

Through testing, it was estimated that 12% of the light energy absorbed by the chip was converted to an electrical current. It is hoped that through more layers of chips, a power conversion efficiency of 20% will be achieved, which would provided a highly efficient power source. As of right now, silicon power cells are 24% efficient by comparison.

The possibilities for the chip after full development are virtually endless. We use batteries and electricity everywhere in our daily lives, and the chips could provide power for everything from laptops to cell phones to entire buildings. It is speculated that by arranging the chips in layers, more power and more current can be achieved. The ultimate goal is in arranging the chips on 3D surfaces so that a great amount of surface area would be covered within small space and would therefore produce a great amount of efficient power.

Sources:

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