Latest Solar Technologies

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Abstract:* We have lived with the sun our entire life and probably most of us take it for granted. But do we realize just how great the sun is and what it can do for us? Our goal is to help you get the most benefit from the sun. Electricity is the lifeblood of modern civilization and we can get as much as we want from the sun. As coal, gas, oil and nuclear energy fuel prices continue to raise solar energy will become even more cost effective. Solar panels are active solar devices that convert sunlight into electricity. They come in a variety of rectangular shapes and are usually installed in combination to produce electricity. The primary component of a solar panel is the solar cells, or photovoltaic cell having low efficiency and high cost. So application of nanotechnology helps us to make solar energy more economical. Nanoscience photovoltaic cells are used to increase the efficiency and to decrease the cost. If nano materials are used in solar panels, solar energy will become even more cost effective over a wider band of solar energy (e.g., including infrared), less expensive so it can be used by more and more people, and to develop more and different uses. The third generation of solar cells is being made from variety of new materials besides silicon, including nanotubes, silicon wires, and solar inks using conventional printing press technologies, organic dyes, and conductive plastics. Black solar cell that absorbs 99.7% of available sunlight. This is a significant improvement over the anti-reflective coatings now used on solar panels. For solar cells, minimum reflectivity is desirable because sunlight that is reflected, rather than absorbed, is "wasted." The reflectivity of a polished silicon wafer surface approaches 40%, giving the wafer its shiny appearance. Adding the industry's typical anti-reflective coating reduces the average reflectivity to approximately 6% and gives the cells their distinctive dark blue color. Production of solar cells using quantum dots could double the efficiency levels currently possible and reduce costs The transparent solar cells is an advance towards giving windows in homes and other buildings the ability to generate electricity while allowing to view from inside. Currently solar energy's biggest problem is the highest cost compared to other sources. But introduction of nanotechnology in solar energy will increase the efficiency and reduce the cost which will give solution to global crisis.

Keywords: Solar Powered hydrogen Generation (Fuel cells), Quantum dots, Dye- Sensitized solar cells, Plastic solar cells, Hairy solar panels, Spin solar cell

I. INTRODUCTTION

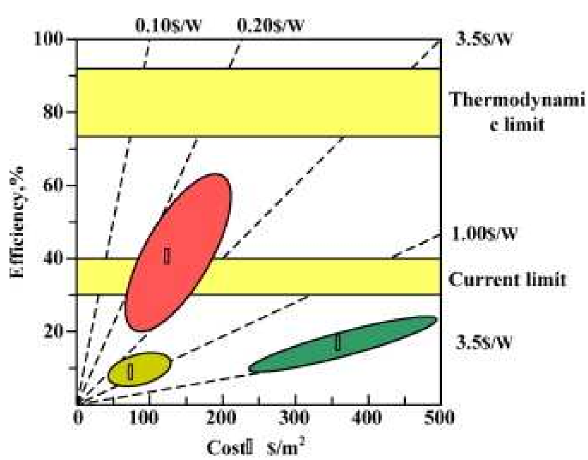
Humanities biggest problems are energy and environment. This is because of sudden rise in population and limited sources of energies are available on earth as well as the current methods of generation of energy such as chemical, mechanical which emits co2 and other dangerous gases which lead to greenhouse effect. Also two important conventional sources of energy are coal & fossil fuels. But if we see today's energy consumption it is large compared with food consumption. It's inevitable. But just how soon will the vital fuel become so scare and expensive that we are forced to make hard choices about how we live? If we do not make the changes in current technology we will cross a critical threshold & global flooding will damage our earth. So one of the best option to avoid energy crises is use of solar energy because the earth receives more energy from the sun is just one hour than the world uses in a whole year. But today's solar panels of first and second generation has low efficiency and high cost. So introduction of nanotechnology in solar energy will help us to eliminate this problem.

Current Solar Technology and Their Disadvantages

There are two types of manufacturing of conventional solar cells known as first generation and second generation solar cells. The **first generation** is made with silicon wafers**.**It is theoretically possible to convert nearly 29 percent of the light into energy using crystalline solar cells. Single crystal silicon wafers are dominant in the commercial production of solar cells. They Consist of a large-area, single layer p-n junction. But Most of photon energy is wasted as heat and require expensive manufacturing technologies. It was the first type of solar panel in the market. Many of the leading firms make both mono crystalline and poly crystalline solar cells for their panels. Polycrystalline panels have a lower efficiency than mono-crystalline solar cells.

The next step was the **second generation thin filmed photovoltaic panels** made of amorphous silicon , and two that are made from non-silicon materials namely cadmium telluride (CdTe), and copper indium gallium diselenide (CIGS). The production methods are complex, but less energy intensive than crystalline panels, and prices have been coming down as panels are mass-produced using this process.

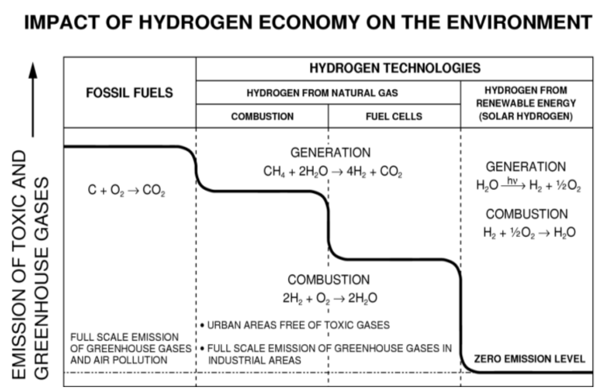
The **third generation** of solar cells is being made from variety of new materials besides silicon, including nanotubes, silicon wires, solar inks using conventional printing press technologies, organic dyes, and conductive plastics. The aim is to improve on the solar cells already commercially available – by making solar energy more efficient over a wider band of solar energy (e.g., including infrared), less expensive so it can be used by more and more people, and to develop more and different uses.



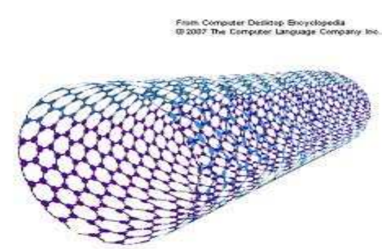
New Solar Technologies

I. Solar powered H_2 Generation in fuel cells

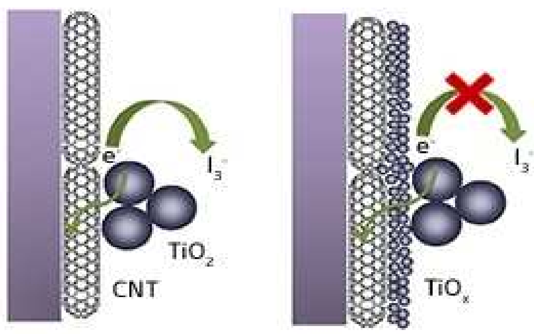
Hydrogen, the third most abundant element on earth's surface, is a true alternative to fossil fuels as an energy carrier .But current technology of generation of H2 using fossil fuels emits CO2 which leads to greenhouse effect. So there is now a process involving nanostructure that has the potential to boost the efficiency of titania photoanodes used to convert solar energy into hydrogen in fuel cells. Automobiles using hydrogen directly or in fuel cells are ready to go, but the biggest challenge has been how to produce hydrogen using renewable sources of energy. Scientists in Japan discovered in 1970 that semiconductor oxide photoanodes can harness the photons from solar radiation and used them to split a water molecule into hydrogen and oxygen, but process was too inefficient to be viable. A team from the University of Arkansas at Little Rock (UALR) has reported an 80% hike in efficiency with a new process. The team used electrochemical methods to synthesize titania photoanodes with nanotubular structures. The photoanode surfaces then underwent a low-pressure nitrogen plasma procedure to modify their surface properties. The plasma treatment increased the light absorption by the photoanode surface. It also removed surface impurities detrimental for photoelectrochemical hydrogen production.



II. Carbon Nano Tubes: DSSC



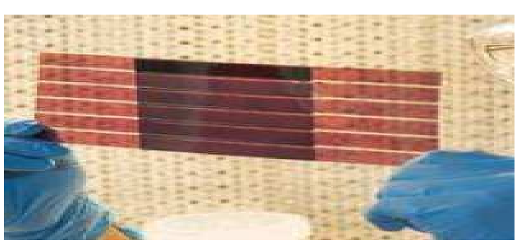
About 40 percent of the solar energy reaching Earth's surface lies in the near-infrared region of the spectrum — energy that conventional silicon-based solar cells are unable to harness. But a new kind of all-carbon solar cell could tap into that unused energy, opening up the possibility of combination solar cells — incorporating both traditional silicon-based cells and the new all-carbon cells — that could make use of almost the entire range of sunlight's energy.



In earlier designs (left), the carbon nanotubes degraded through chemical processes (e-: electrons, I3-: ions in the liquid). Using a thin protective layer of titanium oxide now stabilizes the nanotubes (right), increasing the performance of these cells. It uses low-cost organic dyes and titanium dioxide (TiO2) nanoparticles in place of expensive semiconductor and rare earth elements to absorb sunlight.

A typical dye-sensitized solar cell comprises a porous layer of TiO2 nanoparticles immersed in an organic dye. The dye absorbs the sunlight and converts the energy into electricity, which flows into the TiO2 nanoparticles. The sun-facing side of the solar cell is usually covered with a transparent electrode that carries the charge carriers away from the TiO2 and out of the solar cell.

III. Plastic Solar cell

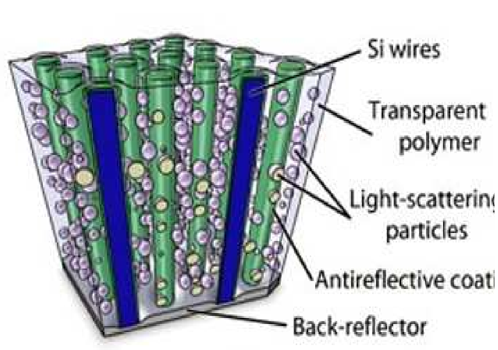


A Flinders University researcher has been developing recently a cheaper and faster way of making large-scale plastic solar cells using a lamination technique. In the conventional method of fabricating plastic solar cells we have to deposit various materials sequentially on top of each other in a sandwich structure but over time, the materials intermix, leading to device degradation. However in new technique involves deposition of materials on two different electrically conductive surfaces, followed by lamination. It gives better control over the material intermixing and thus can give more stable and better performing devices. Therefore the materials can be deposited by printing and devices can be fabricated by lamination at the same time, making the entire process scalable at relatively much lower costs. This is a much cheaper way of fabricating solar cells because you can make a large number of devices in a very short time, and this method of self-encapsulation can potentially help improve the life-span of the device as well.

IV. Spin solar cell

V3Solar has developed a new way to convert the sun's energy into electricity using traditional technology in a new way, and in so doing have discovered a way to get twenty times more electricity out of the same amount of solar cells. Their new device, called the Spin Cell, does away with the traditional flat panel and instead places the solar cells on a cone shaped frame which are then covered with energy concentrators. Once in operation, the whole works spins, making unnecessary the need for tracking hardware and software. Because of the great potential of solar energy, researchers have looked into increasing the efficiency of solar cells by using lenses or mirrors to direct more of the sun's energy onto them hoping to get more electricity out of the same number of cells. Unfortunately, doing so tends to create so much heat that the cells become useless. The engineers at V3Solar took this idea and modified it to prevent such overheating by mounting the cells on a rotating platform; doing so means that each cell only receives extra heat for a very short amount of time and is then allowed to cool as the cone spins. The concentrators form an outer skin creating a hermetically sealed inner environment for the triangular shaped blue colored solar cells. The cone is situated on a base of electromagnets powered by some of the energy that has been converted from the sun's energy by the solar cells, creating a nearly frictionless spin and produce much more electricity than traditional flat panels.

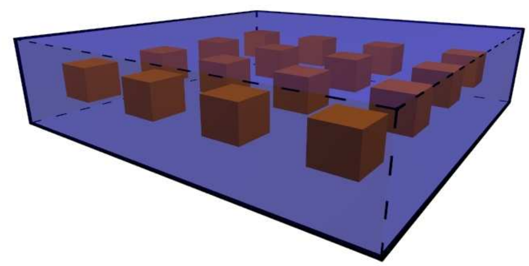
V. Hairy Solar Panel



It uses plastic with a bit of silicon (2% silicon, 98% is polymer) instead of indium gallium phosphide. This structure is *very* good at absorbing light (it has a huge surface area to catch photons). These solar cells have surpassed the conventional light-trapping limit for absorbing materials**.** The light-trapping limit of a material refers to how much sunlight it is able to absorb**.** The silicon-wire arrays absorb up to 96 percent of incident sunlight at a single wavelength and 85 percent of total collectible sunlight.

Part of the reason why so much light is absorbed each of the silicon is wires (30 and 100 microns in length and only 1 micron in diameter) is a good solar cell on its own, and the light that isn't absorbed is scattered and then hits other wires. The flexibility of the panels is also important because it means that they can be manufactured using roll-to-roll processes, reducing production costs compared to non-flexible panels.

VI. Quantum Dots



Quantum dots are particles of semiconductor material with the size so small that, due to quantum mechanics considerations, the electron energies that can exist within them are limited. These energy levels, defined by the size of quantum dots, in turn define the band gaps. The dots can be grown to any needed size, allowing them to be tuned across a wide variety of band gaps without changing the underlying material or construction techniques. The ability to tune the band gap is what makes them desirable for solar cell use. Lead sulfide (PbS) CQDs have band gaps that can be tuned into the far infrared, energy levels that are normally unseen to traditional materials. Half of all the solar energy reaching the Earth is in the infrared, most of it in the near infrared region. With a quantum dot solar cell, IR-sensitive materials are just as easy to use as any other, opening the possibility of capturing much more energy cost-effectively.

Conclusion

The Advancement in current solar technology opens the gate of complexities involve in solar power. It has many positive applications, including the advancement of the solar energy industry, decrement in cost and increment in efficiency. The addition of 3rd generation technology to the solar industry is one possible way to end energy crisis. With affordable, efficient, environmentally friendly energy available and the effect of global warming can be reduced. Yet, there is a need of consistence research for obtaining the desired result. So, the future of solar energy can be very bright – "It's just a matter of what we do with it. "

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