Australian Nanotechnology Alliance
Enabling Tomorrow

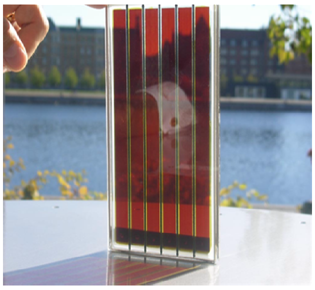
Solutions for Industry & the Environment

Case Study:

Nanotechnology For Electricity Generation

Since 1995 the Dyesol research team has collaborated with the Queensland University of Technology's (QUT) Faculty of Built Environment & Engineering headed by Professor John Bell. The two teams have worked closely to develop new complementary catalyst and electrolyte materials to increase efficiency in DSC and explore the performance

The catalytic counter electrode and the ion conducting electrolyte of a dye solar cell (the cathodic subsystem) have significant performance impacts on energy conversion efficiency. This project targets commercial DSC at 12% efficiency. The project will be investigating liquid, gel and polymer cathodic subsystems and materials, that will expand DSC applications. One aspect of the project involves work on the counter electrode to enable non-vacuum low temperature deposition of platinum catalysts or carbon nanotubes for transparent electrodes based on plastic substrates. Among other things Dyesol will undertake extensive fabrication of devices with different cathodic subsystems using the DSC pilot fabrication line and will then test and characterise the new cells.



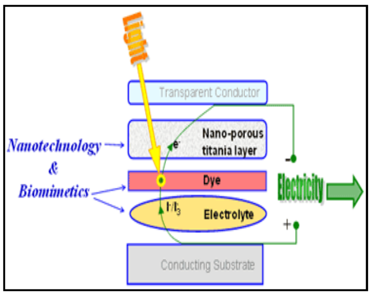
Learning from the worlds most efficient converts of sunlight into useable energy—plants, Dyesol in conjunction with QUTs Applied Nanotechnology Group are working on climate change solutions by building on global research utilising Dye Solar Cell (DSC). This "artificial photosynthesis" uses an electrolyte, a layer of titania and ruthenium dye sandwiched between glass. Light striking the dye excites electrons which are absorbed by the titania to become an electric current many times stronger than that found in natural photosynthesis, thus converting light into green power.

This is a two-step photovoltaic process, unlike the one step process of conventional PV.

Dyesol's technology is different to any classical PV

Dyesol's technology has been identified in forecasts included in the Japanese and EU Photovoltaic Roadmaps as the emerging solar technology. Advantages such as not necessitating the use of high-priced raw materials, a manufacturing process that does not produce toxic emissions, and the potential for rapid efficiency enhancement

- charge separation It is a photoelectrochemical cell: charge separation occurs on interface between a wide bandgap semiconductor (eg titanium dioxide) and an electrolyte.
- it is not a dense film as is amorphous silicon, but a nano-particulate cell: a "light sponge"
- a dye monolayer chemically absorbed on the semiconductor is the primary absorber of sunlight; free charge carriers are generated by electron injections from a dye molecule, excited by visible radiation.



Industry Applications For Dye Solar Cells

DSC can be integrated into metallic cladding for roofs and walls, glass facades of commercial buildings, recharging systems for electronic equipment.

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